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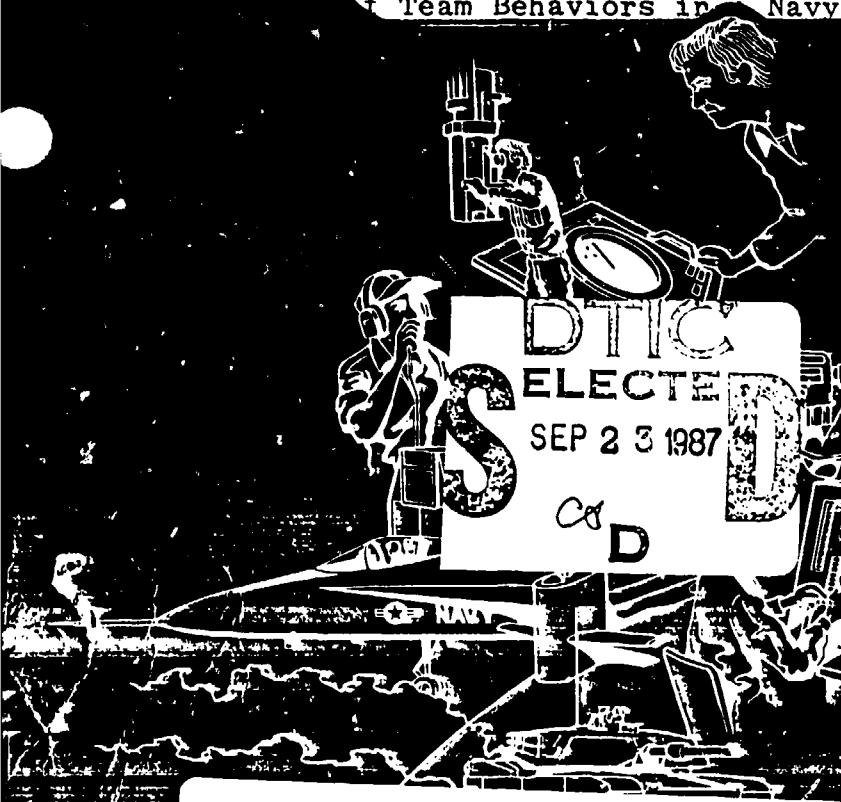

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Measurement of Team Behaviors in a Navy Training Environment

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The research reported here represents the first year of a three-year effort to gain a better understanding of the processes that contribute to Team Evolution and Maturation (TEAM) in operational Navy contexts. The ultimate objective of this research is to provide a basis for enhancing the training, performance, and unit maintenance functions of Navy teams. The general focus of this effort is to measure team evolution and maturation as team members gain experience and knowledge about tasks, each other, and external environmental demands within the context of an operational training scenario. Existing models and methodologies have been synthesized from the team-performance-team-training literatures as a basis for the development of a working model of team evolution and maturation. Based on this model, prototype procedures and methods for measuring team development have been
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defined and developed. These measurement technologies have been tested at the Naval Gunfire Support Department (NGFS) at the Naval Amphibious School, Little Creek. Results of this effort indicate that the developing concepts, methods, and procedures are viable tools for the study of team training and performance. The results support the proposed stage model of team development and provide a sound foundation for the development of interventions for the enhancement of team training.

MEASUREMENT OF TEAM BEHAVIORS IN A NAVY ENVIRONMENT

Ben B. Morgan, Jr., Albert S. Glickman,
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and Eduardo Salas

November, 1986

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EXECUTIVE SUMMARY

The research reported here represents the first year of a three-year effort to gain a better understanding of the processes of Team Evolution and Maturation (TEAM) in operational Navy contexts. This initial effort seeks to document the changes that occur as team members learn about their tasks, each other, and the environmental demands of the training scenarios of the Naval Gunfire Support (NGFS) Department, Naval Amphibious School, Little Creek. There are two ultimate objectives of this research: (1) the systematic identification of team skills, tasks, behaviors, and conditions that influence team training instruction and design; and (2) the development of measures of these variables that will provide a base of knowledge for designing and using interventions to enhance team training programs.

Existing models and methodologies have been synthesized from the team performance/team training literatures as the basis for a working model of team evolution and maturation. This model suggests that the life-cycle of a team consists of as many as seven developmental stages, and that teams may progress through these stages in different sequences and at different rates depending upon the efficacy of their training. The concepts embodied in this model have guided the development of prototype methods for measuring the changes in team behaviors that occur during training. Initial activities at NGFS centered on the development and refinement of these measurement devices. Interviews were conducted with school personnel, actual training sessions were observed, questionnaires were administered, and data collection instruments were tested and refined. Instructors were asked to complete Critical Team Behaviors Forms in order to document the sequential occurrence of team behaviors that contribute to the development of successful teams. In addition, a Trainee Questionnaire was used to measure each team member's perception of the performance, communication skills, degree of cooperation, etc. of the team.

These instruments were administered to four teams during NGFS training. The resulting data tend to support the proposed stage model of team development. In addition, they indicate that these measurement devices are sensitive to the differences between good and poor teams and to the changes that occur in team behaviors during training. Further testing and refinement of these methodologies and the development of interventions to improve team training are recommended for future research.

FORWARD

This document represents the final report of research conducted under U.S. Navy Contract No. DAAG29-81-D-0100, Delivery Order No. 1470, subcontracted through Battelle Columbus Laboratories, Research Triangle Park, NC, 27709. The project was sponsored and cooperatively performed by the Human Factors Division, Naval Training Systems Center (NAVTRASYSCEN), Department of the Navy, Orlando, FL, 32813. Preparation of this report was done with the assistance of Ann Powell, Shirlene Schreckenguest, Chris Condon, and staff members of the Psychology Department at Old Dominion University. Thanks are expressed to Kathryn L. Daigle of Battelle Columbus Laboratories and the Old Dominion University Research Foundation for their attention to many of the technical details of project administration.

Dr. Terry L. Dickinson and Ms. Shari Converse of Old Dominion University, currently conducting a meta-analysis on team performance in collaboration with NAVTRASYSCEN, have been invaluable in searching and compiling available literature reports. The consultants who participated in the research work group meeting--Drs. Jean Dyer, U.S. Army Infantry School, Fort Benning, GA, 31905; Connie Gersick, Graduate School of Management, University of California, Los Angeles, CA 90024; Bruce Tuckman, College of Education, Florida State University, Tallahassee, FL, 32306; as well as meeting participants, Drs. Raymond H. Kirby, Old Dominion University; Bert King, Office of Naval Research, Washington, DC; Roy Perryman, Naval Training Systems Center, Orlando, FL (now with E-Tech); and Dan Windsuch, Naval Personnel and Research Development Center, San Diego, CA--provided invaluable input and suggestions during model development and the formative stages of methodology development. Later in the project, consultant Dr. Robert P. Fishburne of Seville Training Systems, Irving, TX, provided expertise in adapting the preliminary model specifically to training. Additional suggestions and input were also provided by Drs. Irwin L. Goldstein, Bernard M. Bass, and J. Richard Hackman during the formative stages of the project.

Great appreciation is also expressed to Commander, Training Command, U.S. Atlantic Fleet, Norfolk, VA; Commanding Officer, Naval Amphibious School, Little Creek, and Lt. Thomas Grafton, Naval Gunfire Support (NGFS) Department, Naval Amphibious School, Little Creek. Further, we thank the various instructors and NGFS support personnel who showed remarkable patience and understanding while working with the researchers, and great expertise while acting as subject matter experts. Finally, we are grateful for the cooperation of the trainees and their ship commands, without which the project would not have been possible.

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MEASUREMENT OF TEAM BEHAVIORS IN A NAVY TRAINING ENVIRONMENT

> "Performance measurement of teams has been and continues to be one of the most important topics requiring research to improve the use of simulators for design, evaluation and training of multiperson crews" (National Research Council, 1985, p. 73).
>
> "The interdependence of human behavior is a prevailing feature in Navy operations, and effective teamwork or coordination is highly desired...unfortunately, a number of issues have yet to be resolved which impact on team training...what is clear, is that team training, particularly with appropriate training device support, plays an important role in assuring Fleet readiness" (Hall & Rizzo, 1975, p. 5).

INTRODUCTION

As suggested by Hall and Rizzo (1975; quoted above), most Navy operations depend upon the integrated performances of teams of individuals who must coordinate their activities in order to contribute to group decision making, unit performance, and operational effectiveness. Thus, crew, group, team, and unit (CGTU) training is a vital area of Navy research and development, with direct implications for both peacetime readiness and wartime deployment capabilities (Baum, Modrick, & Hollingsworth, 1981; Denson, 1981; Hall & Rizzo, 1975). Early applied experimental research in this area (e.g., Briggs & Johnston, 1967) provided a basis for defining the performance requirements and training procedures for team operations, and for enhancing the transfer of team skills from school to operational settings. However, CGTU research is beset by a variety of theoretical and practical problems, particularly as it relates to the technology available to support the training and performance of operational Navy teams.

Echoing the conclusions of previous authors (e.g., Alluisi, 1977; Baum et al., 1981; Denson, 1981; Goldin & Thorndyke, 1980; Hall & Rizzo, 1975; Nieva, Fleishman, & Reich, 1978), Dyer (1984) has recently pointed to gaps in the analysis, definition, measurement, design, and evaluation of team training and performance. Others have focused on problems associated with the lack of integrated conceptualizations of team performance,

inadequate measurement systems, and deficient knowledge of the developmental processes necessary for effective team training and performance (Salas, Blaiwes, Reynolds, Glickman, & Morgan, 1985). These authors emphasize that inadequate conceptualizations of team performance--particularly as it relates to how teams learn to work together over time--have inhibited the timely development of guidelines for the design of team training instructional systems. The overall impact of these problems has been succinctly summarized by Kribs, Thurmond, and Mark (1977), who said that "a conceptual framework for a general set of instructional strategies for team training does not exist."

The current report summarizes the first phase of an overall program of research consisting of the following five components, the first three of which were addressed in this initial year:

(1) identify the intra- and extra-team variables that contribute to the development and maintenance of team coordination and performance effectiveness;

(2) develop a longitudinal (developmental) model of team training and performance that accounts for changes over time in CGTU activities, interactions, and interdependencies;

(3) develop techniques and instruments to measure the identified developmental variables;

(4) implement and test a refined set of measures on several different types of teams across time; and

(5) demonstrate the utility of the developed methodology.

Thus, this program will provide: (a) the identification of team skills, tasks, behaviors, and conditions that enhance teamwork and provide support for team training design and instruction; (b) a set of measures of team skills that can be used to guide, diagnose, correct, and enhance team performance; and (c) methods for using the measures to enhance the team performance.

This project complements previous Navy research in CGTU training and performance. For the most part, past studies have dealt obliquely with the formative aspects of team development and the influences exerted by dynamic organizational contexts upon the functioning of teams. Their attention has been focused primarily on static descriptor variables (such as task characteristics, team size, and team structure), and not on process variables such as those involved in leadership styles, communication, and interactions among people performing operational tasks. This project seeks to gain a better

understanding of team developmental processes in order to enhance the training and performance of Navy teams.

A clear delineation of the forces and patterns that occur during the life-cycle of a team is essential for the effective organization and management of that work group. Such knowledge will be valuable in determining the specific intervention strategies to be employed by commanders, managers, planners, and trainers to facilitate team development and performance. Currently, little scientific rationale exists for choosing one intervention over another, and there is no data base available to guide decisions concerning the relative utility of different interventions at different phases of team maturation. Thus, at all levels of the command structure, there is a strong need to understand the processes inherent in the development of teams and the kinds of actions that will most effectively enhance team performance. This knowledge awaits research on the evolution and maturation of teams and the development of a model of this phenomenon.

RESEARCH NEEDS

Definition of "team"

The definition of "team" employed here has been shaped by inputs from several previous authors (e.g., Bass, 1982; Baum et al., 1981; Denson, 1981; Dyer, 1984; Hall & Rizzo, 1975; Knerr, Nadler, & Berger, 1980; Morgan, Coates, Kirby, & Alluisi, 1984; Nieva, Fleishman, & Reich, 1978), and it has been chosen to fit the particular purposes of the current project. Our definition is as follows: A team is a distinguishable set of two or more individuals who interact interdependently and adaptively to achieve specified, shared, and valued objectives.

This conceptualization embraces that of Boguslaw and Porter (1962), who define a team as ". . . a relationship in which people generate and use work procedures to make possible their interactions with machines, machine procedures, and other people in their pursuit of system objectives." However, prevailing definitions and practice reflect a concentration on the man-machine (technical) aspects of team training and performance measurement, and a relative neglect of aspects concerned with person-to-person (psycho-social) interactions and adaptations (e.g., "teamwork skills" fall into this category). Socio-technical systems theory argues that both aspects should be considered fully in order to optimize the contribution of each to the success of an organization (Cherns, 1976). Undue emphasis on only one of these aspects likely results in distorted descriptions of system processes and the source of problems, with consequent adverse impact upon training and performance.

Thus, the definition formulated and the work reported here aim to redress the existing imbalance by making more salient the person-to-person factors that affect the performance of teams. Among the reasons for this imbalance are the difficulties involved in measuring team member interactions, and the resulting subordination of concern for the group variables that affect team performance. Relatively few tools are available for recording group phenomena--particularly in "real time," where changes are expected to occur over time in actual work settings. These measuring instruments must be tailor-made to fit the particular circumstance, and used to collect the required data; but they are rarely (if ever) included in training programs. The current research is based upon the premise that the person-to-person (teamwork) factors should be given more attention in team training research and in the construction of training curricula, equipment, and measuring instruments.

Operational Training Requirements

Researchers have concentrated on one or another team feature; for example, formal structure and role differentiation (e.g., Briggs & Naylor, 1965; Horrocks, Heerman, & Krug, 1961; Klaus & Glaser, 1968), cohesion (e.g., Evans & Jarvis, 1980; Tziner, 1982), or communication (e.g., Boguslaw & Porter, 1962; Lahley & Slaugh, 1982; Nieva et al., 1978). These studies do not consider interactions among variables or constraints to their use, which limits their application in operational situations. Similarly, existing taxonomies of military teams describe the types of variables that must be measured, but provide few direct translations to operational Navy teams (see Denson, 1981; Knerr et al., 1980; Nieva et al., 1978). In contrast, the current project is meant to have direct relevance for "team training in the fleet." This context is illustrated in the following description.

The organizational structure for naval combat consists of an integration of ships and support aircraft that defend against air, surface, and submarine threats in pursuit of their mission. Each ship and aircraft coordinates its own sensor and weapons operators, and serves as a component of the larger "battle group" to form complex interactive networks.

Training for battle group team members generally advances from simulation-based instruction on individual operator tasks, through simulation training for subteams and single-platform teams, to simulation for multiple-platform teams. After initial simulator training, individuals are trained as a total battle group using operational equipment at sea, interspersed with additional training in shore-based simulators.

The Navy invests major resources in this training, much of which goes toward teaching members of battle groups how to work together to achieve common goals. For example, one training system designed for combined anti-submarine and anti-surface warfare alone trains teams totaling over 10,000 personnel annually (Surface ASW, 1982, pp. 1-10). Two training systems currently under development at the Naval Training Systems Center (NAVTRASYSCEN), the Surface Anti-Submarine Warfare (ASW) Training System and the Tactical Team Training Device, will cost $200 million to develop and $5 million per year to operate (Rees, personal communication, Feb 1985). The former system trains Combat Information Center (CIC), sonar, bridge and aircraft ASW operators for single-ship operations (Surface ASW, 1982, p. 2). The latter system extends this training to Anti-Surface Warfare (ASUW) teams and emphasizes the coordination among, as well as within, ships and other platforms. Additional team training requirements and costs come from the need to train at the higher (Battle Force) command level, which coordinates activities among battle groups. At lower command levels, separate team training is needed in areas such as air-to-air combat, air-to-ground combat, strike warfare, over-the-horizon targeting, electronic warfare (EW), casualty control, submarine diving maneuvers, naval gunfire support operations, etc.

The ubiquitous and critical nature of team performance, and the high costs of associated training, demand that team training programs be as efficient and effective as available technology will allow. It appears that this requirement is just beginning to be met, and it is anticipated that the current research program will contribute significantly to this requirement.

Problems for Team Training Research

In spite of the critical need to optimize team training programs, some Navy team training efforts have been based on faith in the "natural evolution" of teamwork, "trial and error" training procedures, and conceptualizations centered on individual skills training. Fleet exercises, as well as smaller-scale simulations, provide opportunities for team members to practice together and, presumably, to change from a collection of skilled individuals to a smoothly functioning team (Crowe, Hicklin, Kelly, Obermayer, & Satzer, 1982; Thorndyke & Weiner, 1980). No doubt, some team-specific skills are acquired in these less systematic approaches to team training. However, it is necessary to understand that the performance of teams may be more or less than the sum of the technical knowledge, skills, and abilities of individual team members. Misplaced faith that trainees will learn mainly by trial-and-error may eventually result in wasted time and resources. Team performances may be less than optimal because trainees are not provided opportunities to experience mistakes that involve interpersonal dependencies or

to learn how to handle person-to-person situations. The value of these experiences to team training has rarely been investigated outside of laboratory contexts (cf. Tziner & Eden, 1985; Wagner, Hibbits, Rosenblatt, & Schultz, 1977).

Team trainers often have been designed and used to support team practice (trainees perform tasks in a team environment), rather than to give instruction and feedback on interpersonal behaviors that comprise teamwork. Trainees often may receive instruction on specific team skills only to the extent that instructors have the enthusiasm, expertise, and time to devise team training instructional actions (Surface ASW, 1982, p. 6). Feedback is often inadequate and unrelated to team skills. Trainees can teach team behaviors to each other in the normal performance of team tasks, but this instruction is incidental and less than optimal. Finally, it should be noted that team trainers are often used to teach individual skills, and that this is inefficient instruction for both team and individual performance. These problems are compounded in the Navy by high turnover rates in teams where membership may change from mission to mission. In addition, routine overhauls, deployments, and inspections which compete for time with training requirements, leave, and extra-Navy obligations, create work overloads and distractions that set the stage for suboptimal team performance.

One of the ingredients often missing in team training is an objective, standardized, and practical measurement technology. Traditional team training criteria usually refer to the number of exercises completed per unit time, or to other such summary outcome measures. They say little about the level of team development, the quality of team performance, or the effectiveness of person-to-person interactions within the team. Hence, they provide little information about what is specifically applicable to the development of teamwork during Navy team training (Hall & Rizzo, 1975). There are several methodologies that could be useful for quantifying team performances and processes (cf. Denson, 1981), but as yet they have not been applied to specific Navy situations. Nonetheless, they do provide a starting point for refining methodology.

Finally, and perhaps most importantly, there is a gap in understanding how various patterns of team-member interactions develop, change, and impact performance during the life-cycle of the team. Hackman & Morris (1975) state: "... something important happens in group interaction which can affect performance outcomes" (p. 49). There is little agreement about just what that "something" is, about whether it is more likely to enhance or depress group effectiveness, or about how it can be evaluated, analyzed, and altered. The importance of the evolving and maturing aspects of teams has been expressed by Kennedy (1962), who defined teams as "synthetic organisms."

Unfortunately, this perspective has not widely influenced studies of team behavior. Most research has dealt with fully mature teams whose members have already learned the skills involved in interacting and coordinating. Very little previous research has focused on the developmental processes involved in the time-dependent acquisition of teamwork skills.

Collins (1977) lists several issues which could be the "something" involved in the development of teams, specifying that these factors influence the success of team training. First, he indicates that in order to improve team performance, it is important to understand the degree and nature of group interactions. This can only be accomplished through a task analysis that is comprehensive enough to include all team tasks, skills and abilities requirements. Second, it is necessary to understand both the technological and psycho-social (person-to-person) requirements of Navy tasks, and to be prepared for their impact. Third, analytic techniques must be able to deal with a large number of input, process, and performance variables and with different evaluation strategies. Fourth, it is important to recognize the differences in individual and group goals. The success of a team will depend upon the degree to which these goals are congruent. Fifth, it is important to foster cohesion and a commitment to the group that transcends satisfaction of the needs of the individual. Sixth, it is important that individual contributions be acknowledged as integral and essential parts of total team performance. Last, it is necessary for team performance criteria to take into account the dynamics brought about by factors such as crew turnover, change in rank, and change in task assignments during operations.

Denson (1981) provides examples of the kinds of questions that need to be answered in order to fill the existing technological void (see similar questions in Cissna, 1984; Dyer, 1984). These include:

* What kinds of behavior can be expected at various stages of development?

* How can these stages be recognized and measured?

* What processes underlie changes in team behavior?

* How are these stages of development and their representative behaviors related to team performance?

* What manipulatable factors affect the rate and level of development of the team?

To which one could add:

* What changes can be made in training systems to decrease the time that it takes for teams to function as a coordinated unit, capable of attaining and sustaining high levels of operational readiness?

GENERAL SYSTEMS APPROACH TO TRAINING

While many generalized models of instructional design systems are available (see Pintrich, Cross, Kozma, & McKeachie, 1986; Reigeluth, 1983), the model of Goldstein (1986), reproduced in Figure 1, represents the major steps required in the construction of an instructional system. The major point to be drawn from this figure is that team-training designs must be: (a) based upon thorough analyses of the organizational, task, and individual needs and a clear statement of the objectives of training; and (b) evaluated against established performance criteria and the various goals of the training. The present research effort is governed by this type of general systems perspective. The first year of this effort, reported here, has focused on an analysis of the activities contributing to the "Training and Development" segment of Goldstein's model.

To date, the instructional system model has been applied by Goldstein and others primarily to individual training. It is only beginning to be used for team training as called for by Kribs et al. (1977). Efforts to provide such a framework have centered mainly on the conversion of instructional systems design (ISD) models to the team training situation (see, for example, Ball, 1982; Kribs et al., 1977; Lee, 1977; Slough & Stern, 1981; Thurmond & Kribs, 1978; Wagner, Hibbits, Rosenblatt, & Schulz, 1977). For example, based on their own recommendations (Kribs et al., 1977), Thurmond and Kribs (1978) designed and implemented a team ISD model for the Army Research Institute. Wagner et al. (1977) point out that while most team training research has been conducted "in the same manner" as individual training research, many researchers favor the adoption of a systems approach or ISD model for the "design and development of team training exercises, materials, methods, and devices" (p. 16). Davis, Gaddy, and Turney (1985) applied this systems approach to the training of team skills to nuclear power plant control room crews. Their overall approach is outlined in Figure 2. Central to this approach is the necessity to establish team objectives and to evaluate team training efforts against those objectives. This perspective strongly influences the current work, starting with the development of the conceptual frameworks that structure our rationale and R&D operations.

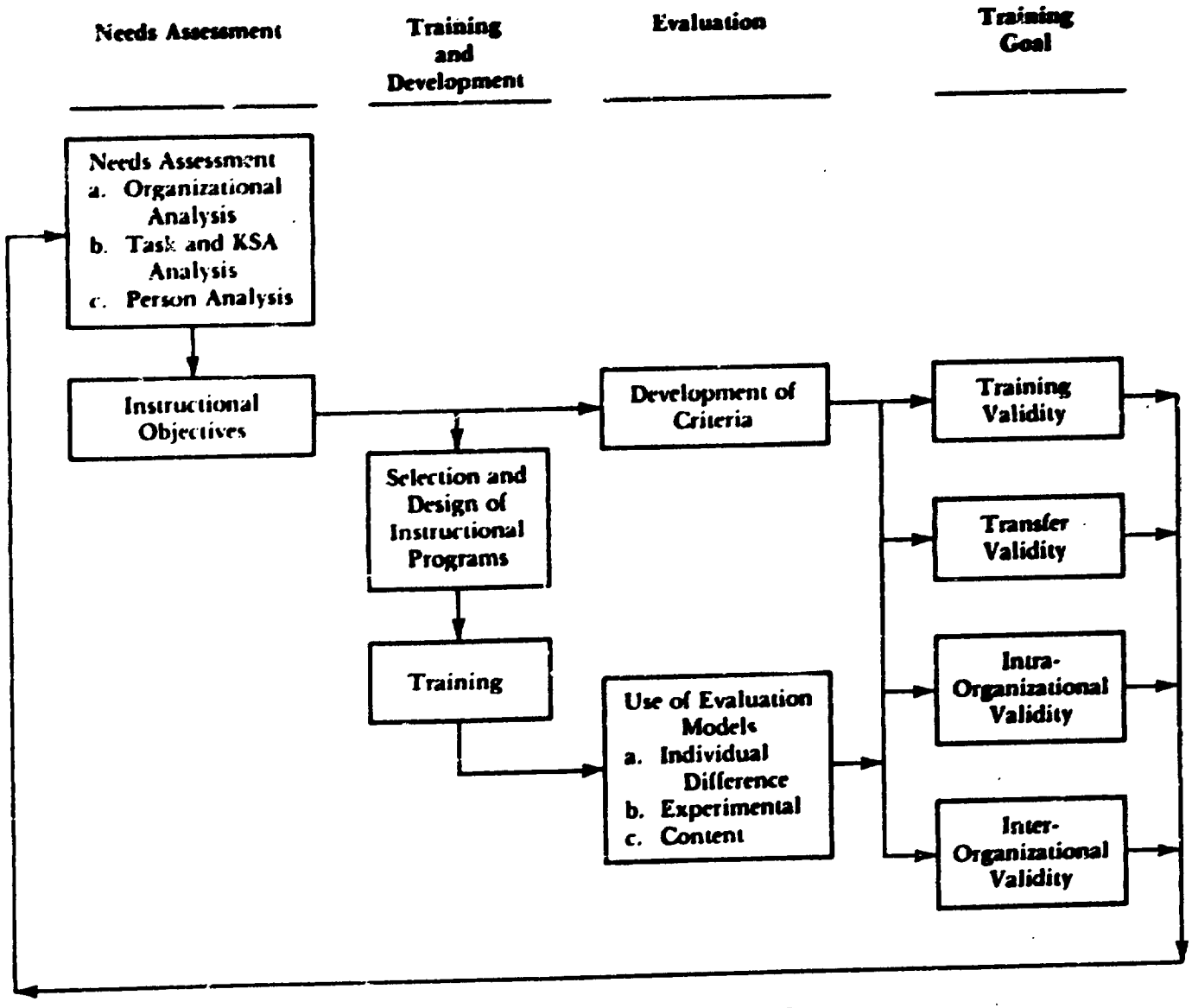


Figure 1. Model of an Instructional Delivery System (From Training in Organizations: Needs Assessment Development and Evaluation, Second Edition, by I. Goldstein, Copyright c 1986, 1974 by Wadsworth, Inc., reprinted by permission of the publisher, Brooks/Cole Publishing Co., Monterey, CA.

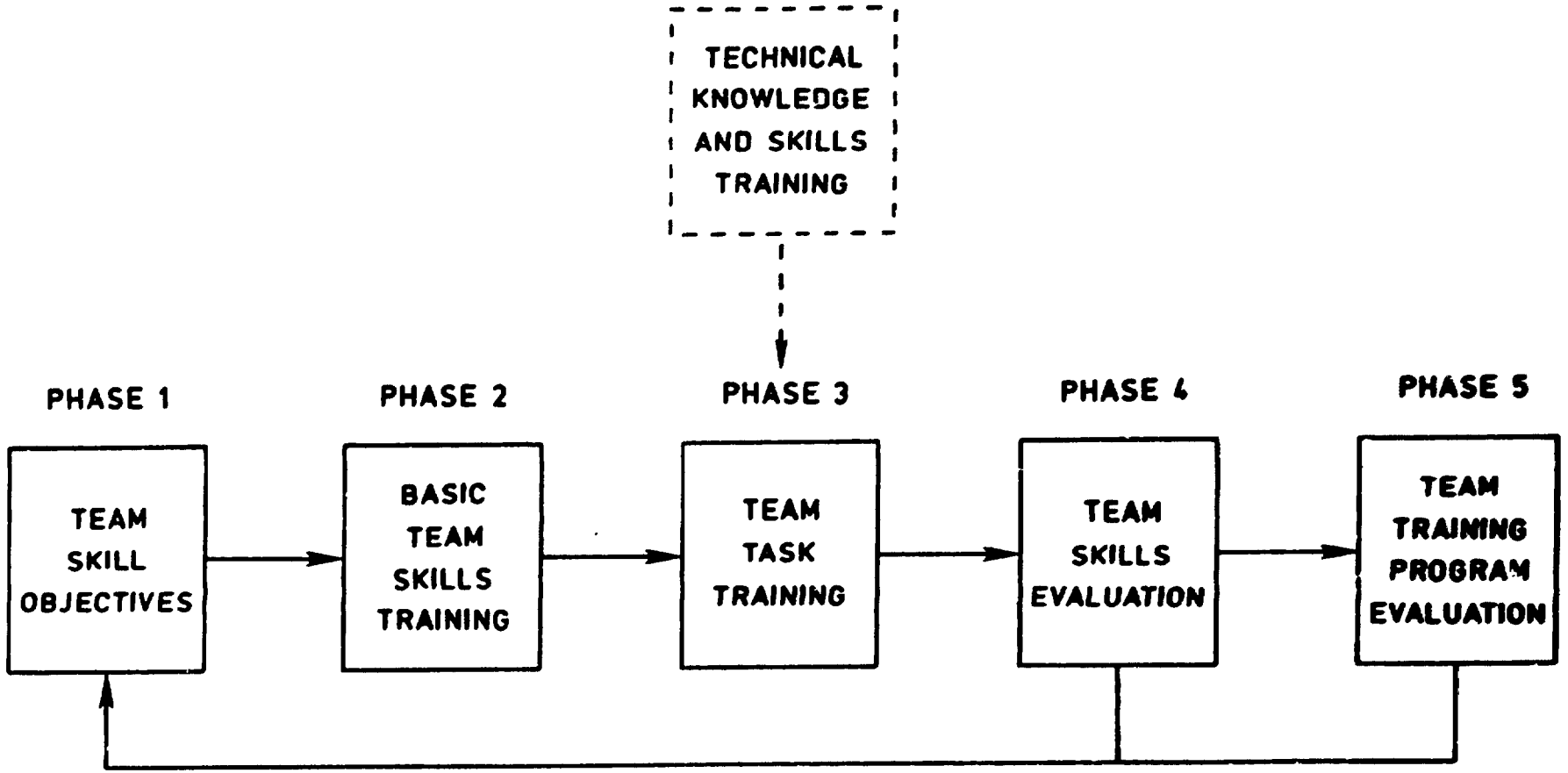


Figure 2. A General Systems Approach Model of Team Training (Adapted from Davis, et al. (1985), pages 1-4)

MODEL DEVELOPMENT

Changes during the training cycle of a team result from learning about: (a) the task; (b) the demands of the job situation; (c) other team members; and (d) working together and communicating with each other. Changes also result from accommodations to altered circumstances and shifts in the composition of the team. Figure 3 presents an overall descriptive model containing the sets of variables that enter into the team training and performance process and a schematic representation of their relationships. The model depicts the variables involved in the processes by which teams achieve their objectives. The levels or "values" of these variables may be considered to be a function of interactions over time among:

(1) the initial mix of individual members' skills, training, values, interests, and motivations;

(2) the physical and task environment, which incorporates job requirements, equipment, and the physical environment; and

(3) the organizational and social environment, which includes such variables as team size and structure, motivational and communication networks, and interdependencies with other units and levels of the system.

The model in Figure 3 is based on a framework adapted from several sources (e.g., Binning & Lord, 1980; Bowen & Siegel, 1973; Hackman & Morris, 1975; Katz & Kahn, 1978; Shifflett, Eisner, Price, & Schemmer, 1982; Tuckman, 1965). It incorporates a majority of previously identified team training and performance variables and is consistent with the team definition presented earlier. However, going beyond previous research, team performance and skills acquisition is viewed as a dynamic sequence of process-outcome linkages occurring within an environmental envelope of organizational and other exogenous forces. Basic to this conceptualization and the current research are the assumptions that within a given environment:

(1) team behavior and process patterns evolve or change over time;

(2) these changes involve ongoing sequences of team behavioral processes, including the performance outcomes of training;

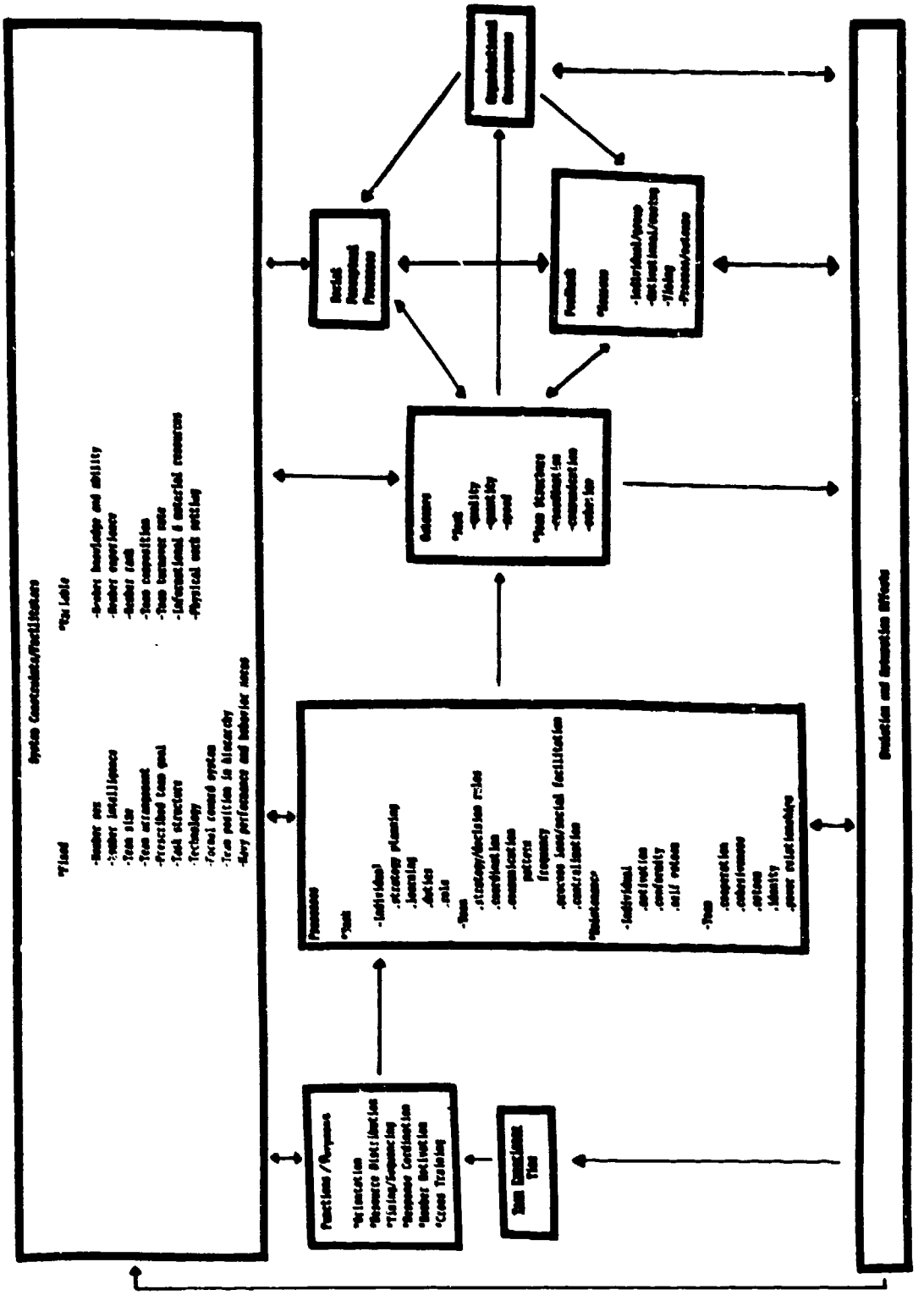


Figure 3. A Descriptive Model of Team Training and Performance Variables

(3) members learn aspects of team-oriented tasks that demand adaptive, interdependent actions.

Support for this viewpoint comes by drawing an analogy with the model provided by Fleishman and Hempel's (1955) work on psychomotor abilities, which showed that the factorial structure of performance changes as practice and learning continues. Similarly (and on a more molecular level), studies of occupational socialization have shown that relationships among social/occupational variables are different at different phases of the socialization process. Goodstadt, Frey, and Glickman (1975), demonstrated this by following Army recruits from Reception Centers, through Basic Combat Training and Advanced Individual Training, to first Permanent Duty Assignments. Similar changes in the teamwork variables and their interrelationships should occur at various points in the life cycle of Navy teams.

Figure 3 presents the variables that have been recognized as important to the study of team evolution and maturation. The following discussion considers the processes that are expected to develop and change over time as a result of training activities. That is, the following section presents and discusses a generalized Team Evolution and Maturation (TEAM) model for the longitudinal study of teams in a dynamic context. The development of this model was based on a thorough review of the team training and performance literatures, as well as reviews of studies of group development, organizational socialization, and longitudinal changes in teams (see particularly Bales & Strodtbeck, 1951; Bennis & Shepard, 1974; Fisher, 1970; Gersick, 1985; Lavoie & Culbert, 1978; Moreland & Levine, 1982; Shaw, 1976; Tuckman, 1965; Tuckman & Jensen, 1977).

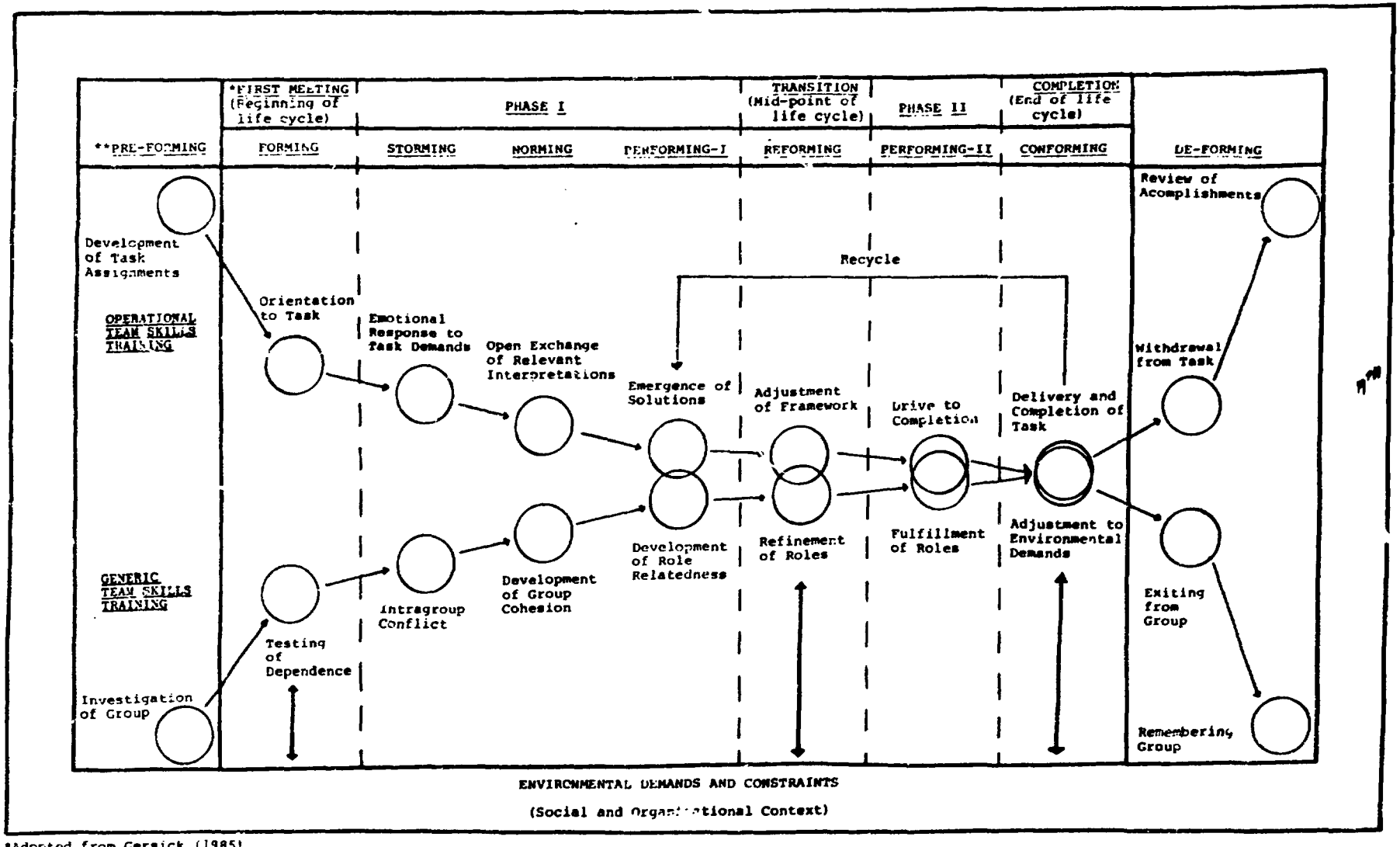
After the literature search and preliminary model development, and in order to derive new insights for the anticipated data collection and other project activities, a research working group meeting was held with experts in both theoretical and applied approaches to team/group performance measurement. This forum influenced subsequent research by recommending that efforts be made to: (1) develop an increased emphasis on the role and nature of training in the team evolution process; (2) note the levels of individual skills that team members bring with them and the changes that occur in the course of training; (3) consider videotaping as a data collection technique; and (4) make better use of the instructors as data sources.

A GENERALIZED MODEL

The generalized model of team evolution and maturation is presented in Figure 4. This model describes a series of developmental stages through which task-oriented teams are hypothesized to evolve. Different teams may begin at different stages and spend different amounts of time in each stage. Progress through the stages will depend upon the characteristics of the team and team members, their past history and experience, the nature of their task, the environmental context, and other variables. Nevertheless, the model depicts the developmental progression of teams from initial ineptness and exploratory interactions to the final levels of efficient and effective performance that are manifested as team members learn to cooperate and coordinate their efforts in order to complete a given task assignment.

The phases shown in Figure 4 represent a compilation of the stages previously identified by a number of authors (cf. Bales & Strodtbeck, 1951; Bell, 1982; Bennis & Shepard, 1956; Caple, 1978; Fisher, 1970; Gersick, 1985; Tuckman, 1965). The major framework for the hypothesized stages comes from Tuckman's (1965; Tuckman & Jensen, 1977) classic descriptions of four phases which he called forming, storming, norming, and performing. Although Tuckman's stages were based primarily on findings from therapy groups and T-groups, they can be translated to describe events that are likely to occur in task-oriented groups and that should be accounted for in any model of team maturation. The extent to which these events (e.g., storming) occur within a given team operating in given circumstances remains to be empirically determined.

Other research, particularly the recent findings of Gersick (1985), suggests that there are other aspects that can be identified as part of the evolution of a team. Specifically, Gersick indicates that at about the mid-point in the life-cycle of problem-solving groups (about half-way through the period of a team's existence), they go through a transition or reforming stage. During this stage, teams re-evaluate their progress to date, reach agreement on final goals, revise their plans for completing their assigned task, and refocus their effort toward task completion. Gersick found that following this transition period, teams concentrate more of their effort on the critical aspects of task performance and focus on accomplishing their task in accordance with stated requirements. Finally, near the completion of the task, efforts are made to shape the team product so that it will conform to the requirement of the environmental demands. Work is finalized and made to fit the specifics of the job situation (Gersick, 1985). Although the



*Adopted from Gersick (1985)
**Adopted from Tuckman (1965)

Figure 4. A Generalized Model of Team Evolution and Maturation

team will always be influenced by the demands and constraints of the social and organizational context in which it operates, it is expected to experience specific interactions during the forming (as it receives instructions for operation), reforming (as it re-evaluates its response to the demands placed upon it), and conforming (as it makes sure that its product meets the demands of the organization in which it operates) stages. These interactions are noted by the heavy vertical arrows in Figure 4.

The model contains a total of nine phases. The active task-targeted processes involve seven phases. Thus, the core of the model begins with the formation of the team during its first meeting (forming), and moves through the members' initial and not always stable exploration of the situation (storming), initial efforts toward accommodation and the formation and acceptance of roles (norming), performance leading toward occasional inefficient patterns of performance (performing-I), re-evaluation and transition (reforming), refocusing of efforts to produce effective performance (performing-II), and completion of team assignments (conforming). These core phases are preceded by a pre-forming stage which recognizes the forces from the environment (environmental demands and constraints) that call for, and contribute to, the establishment of the team; i.e., forces external to the team (before it comes into existence) that cause the team to be formed. The last phase indicates that after the team has served its purpose, it will eventually be disbanded or de-formed. Here, individuals exit from the group (separately or simultaneously) and the team loses its identity and ceases to exist. Individuals return to the social and organizational sectors from wnich they were initially drawn or move to new territories and relationships.

In addition to suggesting the stages of evolution, the TEAM model also hypothesizes the existence of two distinguishable activity tracks that pass through the stages of the model. The first of these, represented by the upper row of linked circles, involves the training-related activities that are tied to the specific task(s) being performed. These activities encompass what Davis et al. (1985) refer to as operational skills training. This includes interactions of the team members with tools and machines, the technical aspects of the job, and other task-related activities. While much of this activity may be carried out by individuals within the group, the model gives emphasis to the development of skills associated with maintaining and improving the team aspects of task performance. That is, as first suggested by Tuckman (1965), it is hypothesized that a part of the team's efforts will be devoted to understanding the task requirements, discovering the "rules" by which the tasks are to be performed, establishing patterns of interaction with equipment, exchanging task-related information, developing team solutions to problems, etc. As the team matures, it will become

more proficient in these interactions and team performance will improve. It is the improved performance of these technical task components that has been the traditional focus of most team-training R & D.

Following Tuckman's (1965) lead, the TEAM model in Figure 4 also shows a second track of team activity. This course is represented by the lower row of circles. It includes those training activities that are devoted to enhancing the quality of the interactions, relationships, affects, cooperation, and coordination of teams. These activities constitute what Davis et al. (1985) call generic skills training. It is hypothesized that a substantial portion of the energies devoted to building better teams can be accounted for in terms of activities that are aimed at people (i.e., other team members) and relationships. These are purposefully committed person-to-person activities designed to enhance interpersonal communications, social relationships, and interaction patterns (i.e., the maintenance of the team as a cohesive unit). These activities include an initial testing of relationships (particularly relationships with the designated team leader), intragroup conflicts (in some teams, but not necessarily in all situations), the establishment of roles, the acceptance of others within the group, the development of cohesion, the maintenance of team structure, etc. As the team develops, it should improve its ability to communicate, coordinate, and interact, and this should also contribute to enhanced viability as a group and to better team performance.

The specific behaviors that occur within each stage of the model for the two lines of the team development process will be defined more fully as additional research is completed. However, based upon the suggestions of previous authors, Appendix A offers a listing of behaviors typical of those that might be assumed to occur within each stage of evolution and line of maturation. As indicated above, some behaviors might not be observed in some teams and given behaviors might not always be observed to occur in the same pattern for all teams (cf. Cissna, 1984). Thus, the concept of the overall flow of team development is more important at this point than the occurrence of specific behaviors.

It is postulated that in order for teams to achieve optimum levels of team performance, the two lines of development (task and group) must be separately enhanced, progressively focused, and ultimately converged so that all activities contribute to improved team viability and performance. Thus, the model suggests that team-training should seek not only to improve the formally programmed task performance but also to enhance the team's ability to communicate, relate, and interact. This is important in order to generate group cohesion and organizational commitment, and to sustain the integrity and viability of the team, regardless of the work requirements imposed at a particular

time. Finally, it should be stated that the TEAM model focuses on evolution and maturation from the perspective of the team per se. That is, it depicts the processes and behaviors that are hypothesized to occur as teams progress through different developmental phases. The model does not yet reflect the various instructional strategies, training methods, or instructor behaviors that might most effectively be applied at various phases of the TEAM model. A later objective of this research program is to develop a training or instructional system model to describe the stages of team training which will optimize progress through the proposed phases of team evolution and maturation.

LINKS TO OTHER MODELS AND EMPIRICAL SUPPORTS

As noted earlier, the overall notion that teams develop through several phases has received empirical support. For example, Terborg, Castore, & DeNinno (1975) present data showing that groups must work together for some time before they begin to "behave as a team" (before they develop norms and are organized to perform). Their data also suggest team performance may be positively or negatively related to cohesion (i.e., member loyalty) at different stages of team development, supporting the notion that different teamwork skills are crucial at different points in a team's life.

Other investigators have been more directly concerned with identifying the stages of team development. In their systematic investigation of 22 teams, Bales and Strodtbeck (1951) identified three phases of team development: orientation, evaluation, and control. They reported that the patterns of team communication and interaction differed significantly across these three stages of development. As already indicated, Tuckman (1965) proposed four stages of development and Gersick (1985) has identified five stages (with particular emphasis on the beginning, the middle, and the ending stages). In their research on group problem solving, Morris and Sashkin (in Kell & Corts, 1980) identified six "phases in integrated problem-solving."

These various authors contribute to the view that team development can be described in terms of "qualitatively different subperiods" (Bales & Strodtbeck, 1951, p. 485), because there is some consistency across authors concerning the nature of the stages of team development. Almost all the authors conclude that teams orient members, generate information, evaluate alternatives, develop a coordinated plan of action, and then commit resources to the performance of the task at hand. Nadler and Berger (1981) further suggest that ". . . teams exhibit fairly consistent phases of interaction over time" (p. 46). While somewhat premature, this statement clearly affirms the need for team training research to focus on the developmental

processes of teams. Indeed, the very purpose of team training should be to speed the movement of teams through the early stages of development, to enhance team-member interactions, and to accomplish this through the optimum application of instructional strategies to the different phases of team development.

Shaw (1976) reports that teams develop relatively rapidly in the early stages of development, working to establish status and role relations, develop team norms, and establish power relations. Teams then become more task oriented, making more efforts to learn about the task, assign job responsibilities, create a plan of action, etc. Shaw's (1976) suggestion that the task and group aspects of development follow different tracks is consonant with the dual-process maturational concept shown in the TEAM model.

The two tracks of task and group processes of development are roughly analogous to the "stimulus-response" and "organismic" orientations to team training identified by Wagner et al. (1977), and to the "technical" and "social" aspects of organizations identified in socio-technical systems approaches (e.g., Cherns, 1976; Cummings, 1976; Davis, 1977; Emery & Trist, 1978). The task-group dichotomy is also supported by McRae (1966), who classified verbal communication patterns of Army teams as "task-specific," "organizational," and "residual" interactions and found that the task-specific interactions were associated with the most effective performance. Similarly, Johnston (1966) found that "task-irrelevant" communications tended to degrade team performance. However, his teams were not observed long enough to show how this outcome might have been different for different stages of team development.

In a factor analysis of communications measures from anti-submarine warfare helicopter crews, Federman and Siegel (1965) identified three factors that seemed to be primarily related to task variables and one related to "leadership control," or team variables. Lahey and Slough (1982) could not reproduce this factor structure, but they reanalyzed only nine of the original fourteen variables. Their elimination of some variables because of dual classification tended to mask the task versus team distinction made here. However, it appears that team communications can be differentiated in terms of the task or team focus of those interactions.

Based on his review of the literature, Tziner (1982) distinguishes two types of cohesiveness, one that is task-related (or "instrumental") and one that focuses on "interpersonal cohesion." The first is based upon a natural sharing of goals and a mutual dependency for the attainment of common goals. It emphasizes the investment of resources, the attainment of goals, the completion of the task, and the reduction of irrelevant

relationships. The second type of cohesiveness establishes team structure and interaction patterns based upon socio-emotional relations and interpersonal attraction. Such interactions produce effective, open, and congenial working relationships. Tziner's review suggests that these two kinds of cohesiveness may lead to different patterns of communication, social interactions, and team performance. He suggests that further research should differentiate these two types of cohesiveness and focus on task-related cohesion (because there has been little research dealing with this concept).

Finally, Davis et al. (1985) describe "operational" and "generic" team skills. Operational skills are needed for the performance of specified tasks, are largely situationally determined, require task-specific communications and task-related cohesiveness, and may not be generalizable to other team tasks. Generic team skills cut across all types of team tasks and include communications about the organization, interpersonal cohesiveness, coordination, cooperation, etc. Operational and generic skills parallel the task and group-oriented activities depicted in the TEAM model.

Davis et al. (1985) also suggest that team training should be designed to develop both operational and generic skills. They point to successes at United Airlines, where cockpit crews are trained in generic skills (coordination and interpersonal communication) that are practiced in high-fidelity simulations requiring high levels of technical performance. These authors call for "a systematic approach to developing and perfecting team skills . . ." (p. 1-1). The current research program attempts to provide such a focus for the study of Navy teams. Specifically, this effort seeks to provide a basis for understanding the impact of team training on the development of both operational and generic skills in Navy teams. However, as indicated above, the current research will seek to redress previous deficiencies by focusing more heavily on the development of generic team skills.

METHODOLOGY DEVELOPMENT

The first step in this research program centered on synthesizing existing methodologies and models from the team performance/team training literature. This literature was then augmented by a thorough search of the group development and individual training literature for applicable references. The resulting working model, described in the preceding section, then served as a foundation upon which to build the prototype system for measuring team evolution and maturation processes in Navy team training settings.

SITE SELECTION

The first preparatory step for data collection involved selecting a team training site. Using the TEAM model as a guide, a list of desirable primary and secondary team characteristics was formulated. These selection criteria are listed in Appendix B. A total of ten team training systems were evaluated against these criteria during the site selection process. This evaluation included visits to each of the potential data collection sites and interviews with key individuals at these sites. The sites visited are identified in Appendix C.

It was recognized that no single team training system would be able to offer all of the desired characteristics. Further, availability of training teams for research purposes was found to vary within each specific system. Therefore, the final selection of a data collection system represented an effort to obtain the best possible combination of the critical factors listed in Appendix B. Ideally, the system would provide teams that were at the beginning of their life-cycle and that would remain intact for the duration of the period of observation.

NAVAL GUNFIRE SUPPORT SCHOOL TRAINING

At the end of this site selection process, the Naval Gunfire Support (NGFS) Department, Naval Amphibious School, Little Creek, Norfolk, Virginia was selected as the first data collection site. It was deemed to represent the best conditions for the planned research.

Before a ship can be certified as operationally ready for deployment, its gunfire support team must meet the Navy's prescribed qualification standards in simulated exercises at this one-week school and then, within 90 days, in live firing exercises. These imperatives assure command interest and high levels of commitment to NGFS training by all concerned. The

membership of teams is required to remain the same through school training and firing range qualification tests. Although members are supposed to enter training already proficient in their individual task assignments, teams are typically composed of 50% to 100% new members with little or no actual gunfire support experience, and they generally have not worked together as a team prior to arrival at the school.

Crews engaged in NGFS training actually consist of three teams: the Bridge team, consisting of approximately three members; the Combat Information Center (CIC) team, consisting of eight members; and the Plot team, consisting of five members. In the current school setting, these three teams were physically located in different spaces linked by sound-powered telephones. Radio communication also exists between the ship and the shore fire-control party (simulated in the school setting). The CIC team is the most critical of the NGFS teams because it must interface with both of the other shipboard teams and the shore-based spotter who is directing shore bombardment. In addition, CIC has the greatest degree of team interdependency, communication, and interaction. The duties of each CIC team position are described in Appendix D.

On-line performance measures are provided at the school by mid-term and final test exercises and later by qualification tests at the live firing range. Furthermore, the simulators at the NGFS were readily accessible to the researchers, and high levels of interest and cooperation were expressed by the administrators of the school. Thus, the CIC component of NGFS was considered to be an especially attractive site for conducting the current research. In addition, it was felt that extrapolation to other team training sites would be maximized by this selection because the NGFS training operation is similar in many respects to other CIC training situations in the Navy.

DATA COLLECTION AND MEASUREMENT

It is obvious why most studies of team performance/training have taken place in the laboratory. In the field, with teams of more than two or three members engaged in "real" work or training, the challenges that must be met in order to obtain a clear picture of "what is going on" quickly become formidable. The experience imparted by Nieva, Fleishman, & Reick (1978), in describing Army units engaged in bridging a river, provides just one illustration. In their research, practical obstacles led the researchers to resort to less refined descriptions and measurements than originally contemplated. Others have had similar experiences.

In the current research, special problems were encountered because of the requirement to determine how specific sets of interpersonal behaviors change as people work together. A major objective was to describe this process, not just infer it post hoc from outcomes. As measurement procedures were field-tested, it became clear that even though CIC team members were close to each other and to the observers, it was not easy to keep track of what eight people (plus an instructor), engaged in a fast-paced complex operation, were doing. Thus, several procedures were considered as ways to slow the pace or reduce the number of required observations. The first option led to the consideration of video transcriptions which would allow the action to be stored, stopped, and rerun. Another option involved the application of sampling strategies to reduce the volume of data to be analyzed. The use of instructors and trainees as surrogate sources of information was also considered. In this regard, it has been argued that structured observational methods need to be coupled with alternate complementary data collection methods (Martinko & Gardner, 1985). Thus, data sources were chosen to reflect all possible sources of information, including subject matter experts (instructors), trainees, and trained observers.

A primary goal of this phase of the project was to determine which data collection procedures were most useful, and to illustrate how the recommended methods, and information generated by them, might be used--first in the major data collection efforts to take place during the next year of research, and eventually in the design of interventions to enhance team training systems. Although data collection was constrained by the project schedule, the number of teams passing through NGFS training, and the amount of time during training that students and instructors could devote to this project, the data collected to date serve to illustrate the viability of the methodologies developed in this project. Several procedures were field tested and discarded or revised and standardized. In addition to using several observational and interview techniques, three data collection instruments were developed specifically for use in current research. These involve the collection of critical team behavior reports from instructors and self reports of changing perceptions from team members, and the completion of a demographics form by trainees. These procedures involve a combination of time and behavior sampling in order to bring them into conformity with practical time demands. The instruments are described below.

Critical Team Behaviors Form

A critical incident approach was used to develop a Critical Team Behaviors Form to be used by instructors as a means of identifying specific effective and ineffective behaviors of team members. This form included an assessment of the initiating and target team member involved in the behavior. A sample of this form is given in Appendix E. A full exposition of the critical incident technique was first presented by Flanagan (1954) and has been used extensively to determine training needs, curriculum design, and performance requirements in the Navy (e.g., Glickman & Vallance, 1958) and elsewhere. The critical incident technique was adapted here to exploit the instructors' expertise with respect to the team behaviors that are crucial to team success or failure. A secondary purpose was also served by using the instructors; namely, incidents that have high salience for instructors should also have high face validity for their cohorts, thus increasing their meaningfulness when translated into research findings and recommendations.

The first step in the development of the Critical Team Behaviors Form was to conduct semi-structured interviews with NGFS instructors. The instructors were asked questions concerning the specific categories of behaviors related to the conceptual framework of this research. That is, interview items were derived from the variables identified by the TEAM model. The results of these interviews were supplemented by observations of the teams undergoing training. This approach helped to ensure that no important variables were missed and that the interviewees were not threatened by the use of heavily structured survey instruments (Rynes, Heneman, & Schwab, 1980). In the present instance, all instructors were accepting and cooperative.

The first version of the semi-structured interview was conducted with six instructors at the Naval Gunfire Support School. The interviews were tape recorded and transcribed, and the information obtained was content analyzed and categorized. The initial interview responses were quite redundant, so the interview was revised to encourage the instructors to volunteer responses more freely and to generate a broader range of responses. This procedure resulted in the extraction of more than ninety critical incidents (such as "communication," "coordination," etc.) all of which could be categorized within the dimensions of the TEAM model.

The next step in the process involved categorizing the critical incidents into dimensions. A content analysis of all the critical incidents produced seven different dimensions: communication, adaptability, cooperation, acceptance of suggestions or criticism, giving suggestions or criticism, team spirit and morale, and coordination.

The critical team behaviors were dichotomized to reflect the aspects of each item that were believed to be effective and those that were thought to be ineffective with respect to successful team training performance. The Critical Team Behaviors Form was designed so that each page of the form contained either the effective or the ineffective behaviors of a given dimension. Instructors were asked to place an X in the box under the position of each member involved in an observed critical behavior. The initiator of the behavior was denoted by circling the appropriate X. The instrument was pilot-tested with two instructors at NGFS who made several suggestions regarding the design of the form. Revisions included the addition of a column for indicating that the behavior involved an external person (i.e., outside of CIC).

At present, the Critical Team Behaviors Form is 15 sheets in length and takes up to 45 minutes to complete (see Appendix E). The cover sheet contains questions regarding ship and training session (day of training, morning or afternoon). Each of the remaining 14 sheets contains a single dimension with a list of critical team behaviors. The back of each sheet provides space for listing any behaviors that do not fit into the established categories, as well as for indicating whether or not any of the incidents occurred more than once. This allows for the flexibility of recording any additional critical behaviors not listed on the form.

In order to maximize recall of responses, the instructors were told to formulate their responses on the basis of the last exercise of the just-completed session. They were requested to fill out a questionnaire at the end of the first afternoon training session and every morning and afternoon thereafter until the team completed its training.

Trainee Questionnaire

Based on the work of James, Gustafson, & Sells (1985), a 22-item Trainee Questionnaire was developed to measure the changing perceptions of trainees regarding individual and team ability, motivation, and expertise. It was designed to reflect dimensions that relate to individual team members as well as the team as a unit. These dimensions are as follows: concerning individuals--(1) knowledge of duties of NGFS team members, (2) motivation, (3) role clarity, and (4) experience and prior training; concerning the team--(1) communication, (2) cooperation and coordination, (3) experience and prior training, and (4) power relationships. Items were generated for both of these categories then pilot-tested for readability and redundancy. A copy of this questionnaire is reproduced in Appendix F.

Pilot-test interviews revealed that the trainees did not "like" two of the Trainee Questionnaire items concerning power relationships. They felt that these items forced them to negatively evaluate their teammates. Often they refused to answer them, or they answered in what was seen as the most socially acceptable manner. Therefore, these items were not included in the current data analysis. However, they have been rewritten and will be used in a revised format for future data collection. It was also found that there were no major problems with readability, but that several items were regarded as repetitious. After refinements were incorporated, the questionnaires were administered to four ships' CIC teams (three of which also provided critical team behaviors data). This questionnaire was administered after each morning and afternoon training session. It required approximately 15 minutes to complete. However, due to circumstances beyond the control of the experimenters (e.g., nonparticipating teams or instructors, etc.), the questionnaire was not completed for all training sessions.

Team Demographics Form

A form was developed to gather general information regarding overall Navy and NGFS experience of the team members. This form was pilot-tested three times in order to achieve economy of administration and consistency of answers (e.g., the term "rate" often was confused with "rank"). It required 5-10 minutes to administer. A copy of this form is given in Appendix G.

RESULTS AND INTERPRETATIONS

As indicated above, data collection in this effort consisted of interviews and observations, reviews of training materials, recording of performance scores, and administration of the Team Demographics Form, the Critical Team Behaviors Form, and the Trainee Questionnaire. The following sections of this report summarize the data obtained from these sources. The first section is based primarily on observations of training, interviews of instructors, and reviews of course materials and documentation. It presents a schematic representation of the major components of NGFS training and relates these phases to the phases of the TEAM model presented previously. The second section describes the demographics and performance characteristics of the teams studied here. The third section summarizes the results obtained with the Critical Team Behaviors Form, and the fourth section presents data from the Trainee Questionnaire. In total, the results summarize the ways in which the teams differed from each other and the extent to which these characteristics changed during training.

OPERATIONAL MODEL OF NGFS TRAINING

Direct observations of training, as well as interviews with the instructors, indicated that NGFS training occurs in six distinct sequential phases. The phases are identified as follows: pre-exercise, basic missions, pre-midterm, midterm, post-midterm, and final. The pre-exercise phase occurs on the morning of Day 1. The basic mission phase occupies the afternoon of Day 1. The pre-midterm phase begins the morning of Day 2 and runs until the beginning of the mid-term exam. The midterm is typically the afternoon of Day 3, but has been observed as late as the morning of Day 5. The post-midterm phase occurs between the midterm exam and the final exam (typically the morning of Day 4). The final exam is scheduled for the afternoon of Day 4 but may occur as late as the afternoon of Day 5. Day 5 is used only for those teams which are unable to complete the training in the normally allotted four days.

The NGFS training system consists of three components: the instructor, the individual, and the team. In order to illustrate the content of the various phases of this system, a model was constructed to show the activities and relative magnitudes of contributions made by the instructor, individual and team components during each phase of training. This schematic representation of NGFS training is given in Figure 5. Each frame (A-F) of this model contains several kinds of information. Specifically, the relative importance of each training component

to the overall training effort is indicated by the size of the box containing that component. The general direction of flow and the relative amount of contribution is indicated by the direction and number of arrows between the instructor, the individual, and the team components. Behaviors pertinent to the phase are listed for each component. The behaviors for the instructor have been separated into those directed at the individual and those directed at the team.

Pre-exercise (Frame A of Figure 5)

In this orientation phase, instructors list job assignments and present the basic terminology and purpose of Naval Gunfire Support. It is classroom training accompanied by a familiarization tour of simulator spaces. During this phase, the instructor is the dominant person (as is usual in the classroom). Instruction focuses on the individuals' skills, behaviors, and accommodation to the training environment. Only minimal attention is given to team interactions, interdependencies, and teamwork concepts.

A major event in this phase is the introduction of the instructor into the group. This is the first step of a process that will see the instructor become an integral and controlling member of the group, followed by a deliberately diminishing role as the team becomes progressively more competent and confident, and its leader assumes responsibility for training.

Basic Missions (Frame B of Figure 5)

The basic missions phase is the first training activity conducted in the simulator. This phase consists of a set of five missions of relatively low complexity which serve as a point of departure for all subsequent training. These missions require the exercise of all the basic technical skills necessary for the successful completion of training. However, the exercises are paced so that time is allowed for development or refreshing of individual skills and the establishment of a communication network. Although the instructor remains the dominant aspect of training, he also becomes integrated into the team during this phase. There is a continuing emphasis on individual behaviors.

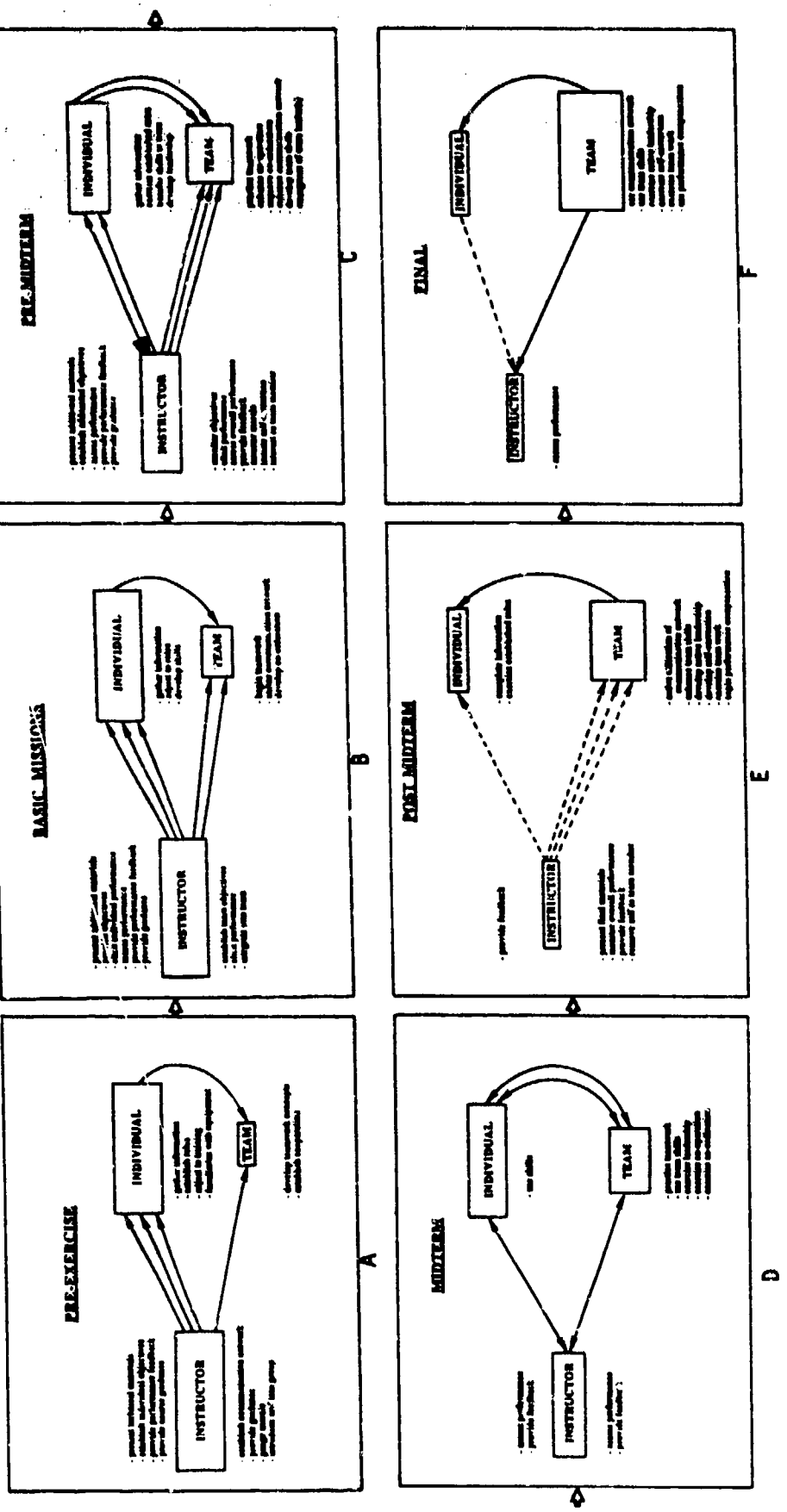


Figure 5. Training Component Interactions During the Phases of NGFS Training

Pre-midterm (Frame C of Figure 5)

During this phase, simulator missions of relatively greater complexity are presented in a stepwise fashion, with each new exercise requiring a somewhat greater degree of skill. The team component takes on greater significance in this phase, but the instructor is still dominant overall.

Several crucial events take place during the pre-midterm phase. First, individual technical skills are developed to a level that is adequate for successful mission completion. Second, the instructor's training emphasis shifts from individual behaviors to team behaviors. In doing this, the instructor often interacts as a team member during this phase. Third, individual leader(s) begin to emerge from within the team. Fourth, the team begins to develop a self-correcting mechanism whereby team members attend to the prevention and correction of errors. Successful teams will quickly learn to monitor and correct their own behaviors rather than rely on the instructor for this function. The development of these self-correcting behaviors is thought to be vital to the team's success and to maturation as a self-sufficient unit.

Midterm (Frame D of Figure 5)

The midterm is a mandatory examination which the team must pass before training is allowed to continue. A failure usually results in an immediate retake of the exam. Unlike the final, the midterm can be a hybrid situation. That is, if unsatisfactory performance is observed early in the midterm, the remainder of the exam will be given as an additional training exercise. Thus, the midterm can serve as an additional unit of remedial training for the team.

To the extent that this is treated as a test situation, the interactions among the three training components tend to be reduced during the midterm. Specifically, during testing, the instructors suspend instructional interactions and force the team to perform autonomously. However, if the team's performance is such that the session becomes a remedial training exercise, instructor interactions mirror those levels generally seen during the pre-midterm phase. In Gersick's (1985) terms (see Figure 4), the end of the midterm marks the transition point (or reforming stage) in team maturation. The outcome of this transition becomes clearly evident in the post-midterm phase.

Post-midterm (Frame E of Figure 5)

The post-midterm phase includes training at the highest levels of NGFS mission complexity. These missions are highly interdependent composites involving earlier missions with overlays of additional requirements.

The team component now becomes the dominant aspect of training. The instructor component undergoes a major transformation as he deliberately begins to withdraw from membership in the group (the weakening force denoted by the dashed line). All individual behaviors become subordinated to team behaviors. The team behaviors include assumption of active internal leadership, enhancement of team skills, and demonstration of the ability to be totally self-correcting.

Final (Frame F of Figure 5)

The final examination is the summative criterion of NGFS training. The team is tested on all mission elements included in previous training. During this phase, the instructor's interaction is reduced to that of an observer because of the testing requirements of the phase.

The relative roles of the training components remain the same as for the post-midterm phase, but there is a major shift in direction of contribution. Here, the team makes active contributions to both the individual and instructor components. The team contribution to the instructor is in the form of performance information for criterion assessment. The contribution to the individual component becomes salient in the interaction of team-oriented behaviors and values that make a team more than the sum of its individual parts. In summary, it is in this final phase that the team uses all of the team skills and abilities that have been developed in the course of training to the prescribed standards of operational readiness.

The six phases of NGFS can be related to the phases of the general TEAM model of Figure 4. In Figure 6, these phases are represented in the same format as the earlier TEAM model using the phase descriptions that are appropriate to the NGFS training process. For comparison purposes, the vertical divisions that separate the phases of the TEAM model remain the same for the NGFS training model. The individual circles are labeled with representative behaviors from the appropriate phases. It can be seen that NGFS training may be described meaningfully in terms of phased evolution and maturation. However, correspondence with other details of the original conceptual model awaits further empirical validation.

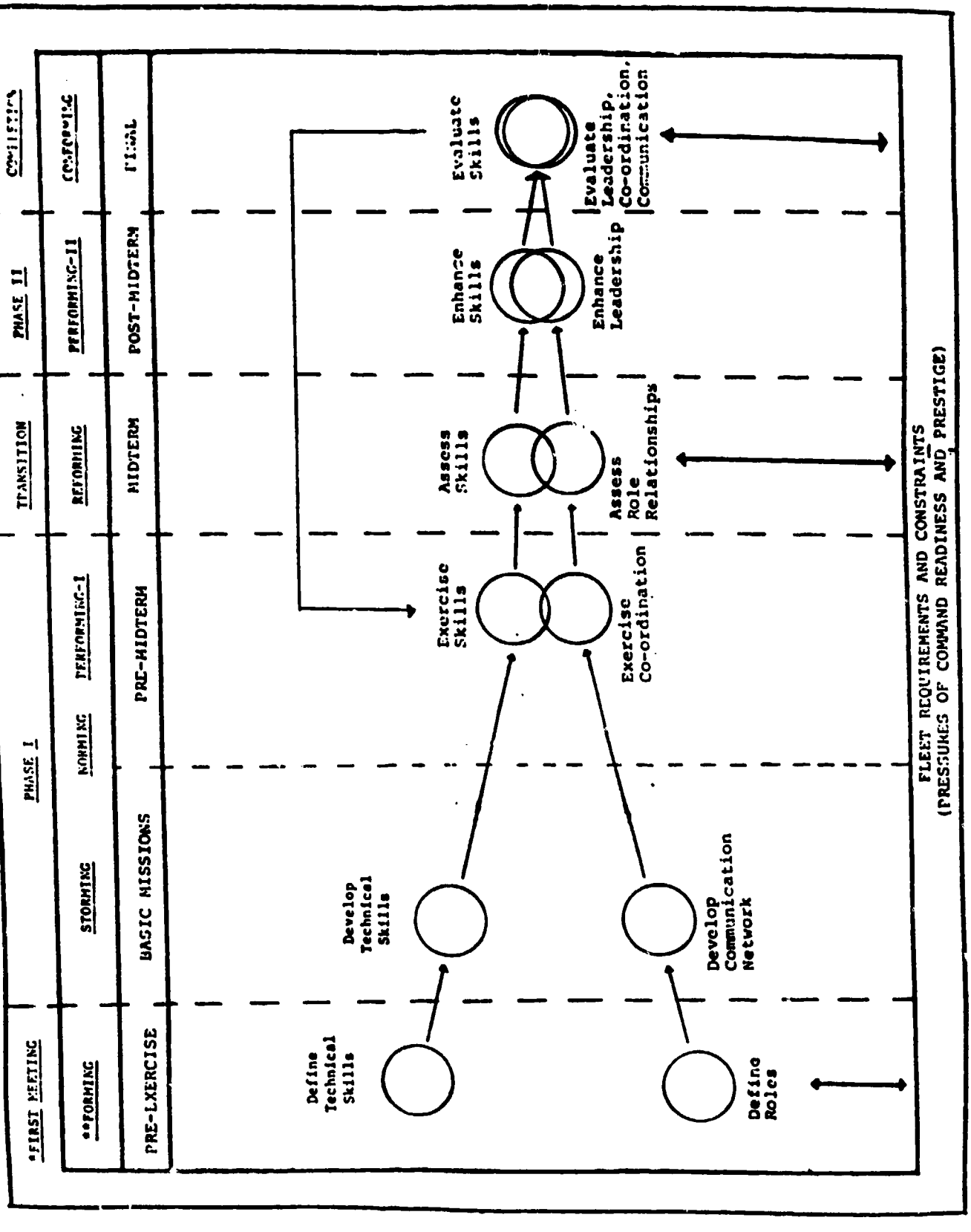


Figure 6. Stage Model of Naval Gunfire Support Training

*Adopted from Gerwick (1985)
**Adopted from Tuckman (1965)

TEAM DEMOGRAPHICS AND PERFORMANCE

The Team Demographics Form was completed by four teams consisting of eight members each. The demographics for these teams are summarized in Table 1. These data indicate that Teams 2 and 4 were staffed with more non-rates who tended to bring less overall military experience to the team. In addition, Team 1 reported having more experience with the current team than did the other groups.

As indicated above, each ship is required to pass (with a minimum score of 70) a midterm and final examination. On occasion, if the ship is doing poorly, more than one midterm may be given. That is, the instructor is allowed to request that a team be allowed to repeat the midterm if it is believed appropriate. If the team fails to pass the final exam, the ship is not operationally ready and cannot deploy. It is mandated that ships which fail to achieve operational readiness be reported to Congress. Therefore, it is very important for the ship to do well on these exercises.

For the four teams examined here, the initial midterm and final scores were as follows: Team 1 - 96, 91; Team 2 - 70, 87; Team 3 - 70, 76; and Team 4 - 85, 91. These scores reflect the judgments of the instructors concerning the accuracy and effectiveness with which teams perform the assigned exercises. Each team begins with a potential perfect score of 100, and points are subtracted by the instructor for errors and failures to follow prescribed procedures. Teams that encounter more serious problems will have more points subtracted and will, therefore, receive lower scores.

Instructors are required to write a brief descriptive account of each ship's training history. Comments taken from these accounts indicated that Team 1 "...had an outstanding attitude and [was] highly motivated...[and] well coordinated. The teamwork was evident from the first day with everyone helping each other out....A very impressive week." On the other hand, comments concerning Team 2 (which had already failed training once and was repeating with a new GLO and AGLO) indicated that "...Basic grid missions horrible...dependent upon instructor...team members failed to get involved." Comments concerning Team 3 indicated that "After a very slow start, the team started to pull together and do things the way they were taught." Team 4 showed "...outstanding results despite having had no practice in over a year." These test results and comments indicate that even among teams that have achieved a standard minimum competency, there is likely to be a considerable amount of variation in the levels of team performance.

TABLE 1

Team Demographics

	Team 1	Team 2	Team 3	Team 4
No. of Officers	2	2	2	2
No. of Petty Officers	5	3	5	3
No. of Non-rates	1	3	1	3
Range of Years in Service				
Officers	2.1-3.0	2.7-8.0	4.8-9.5	1.0-4.1
Petty Officers	3.8-15	2.2-7.0	2.5-10.2	2.3-4.6
Non-rates	1.2	1.5-2.2	1.2	0.7-1.3
Range of Years in Rank				
Officers	0.1-2.8	0.7-2.8	1.0-1.8	0.7-1.0
Petty Officers	0.1-3.0	0.2-0.7	0.2-2.5	0.1-2.5
Non-rates	0.4	0.3-0.8	0.3	0.4-0.8
Range of Years in Command				
Officers	1.0-1.6	0.2-0.3	0.6-0.8	0.2-1.0
Petty Officers	0.2-3.2	1.3-2.6	0.4-2.8	0.3-2.7
Non-rates	0.5	1.0-2.0	0.5	0.1-0.5
Range of Year on Team				
Officers	0.7-0.8	0.1-0.3	0.1-0.2	0.1-0.2
Petty Officers	0.1-2.0	0.1-1.8	0.1-1.5	0.2-1.1
Non-rates	0.1	0.1-1.0	0.2	0.1-0.2

CRITICAL TEAM BEHAVIORS

This section contains a summary of the findings obtained from the analysis of the critical team behaviors as reported by NGFS instructors during the training of three teams (data were unavailable for the fourth team). Table 2 indicates the sessions for which critical team behaviors were obtained.

TABLE 2

Sessions and Ships for Which Critical Team Behaviors Were Reported

	DAY							
	1		2		3		4	
	AM	PM	AM	PM	AM	PM	AM	PM
Ship 1	--	X	--	X	--	X	--	X
Ship 2	--	X	X	X	X	--	--	--
Ship 3	--	X	--	X	--	--	--	--

Responses to the Critical Team Behaviors Form were examined in order to identify trends in the data and to compare the characteristics of the more effective teams with those of the less effective teams. As indicated earlier, the performance of Team 1 was generally rated as being superior to Teams 2 and 3. Thus, the current analyses were designed to (a) identify how Team 1 (the relatively good team) differed from Teams 2 and 3 (the relatively poorer teams), (b) examine the development of team roles over time in the good and the poorer teams, and (c) identify those behavioral dimensions that were most sensitive to the differences between good teams and poor teams over time.

Differences Between Teams

Detailed examination of the specific behaviors reported within each dimension of the critical team behaviors revealed that the effective team exhibited a wide variety of different effective behaviors (i.e., more of them were reported to have occurred), and that the teams with lower levels of performance exhibited less variety with respect to the different effective behaviors. For the effective team, almost all effective

behaviors within each dimension were observed at least once during the course of training. On the other hand, there were specific behaviors within the dimensions of Effective Acceptance of Suggestions or Criticism, Effective Giving of Suggestions or Criticism, and Effective Coordination that were never observed in the less successful teams. For example, Teams 2 and 3, no team member ever indicated or corrected another member's mistake without announcing it to the whole team (Giving Suggestions or Criticism), or asked other team members to inform him when he made a mistake (Acceptance of Suggestions or Criticism).

On the other hand, in the more effective team (Team 1), several specific behaviors occured in every session, whereas the less effective teams exhibited few regularly occurring behaviors. For example, in the Team 1, the GLO (the formal leader) engaged in the same specific Effective Communication and Effective Adaptability behaviors in every training session. Likewise, the CIC Supervisor (the informal leader) was involved in the same Effective Team Spirit and Morale behaviors in every session. In contrast, no team member in the less effective teams exhibited any systematic behavior patterns. The absence of regularly occurring effective behaviors in the less effective teams might have resulted from the fact that no clear leader emerged in those teams.

Summaries of the frequencies of occurrence of the behaviors within each behavioral dimension are given in Table 3 for each dimension and team. These data indicate that, overall, Team 1 (the more effective team) exhibited a larger number of effective behaviors and fewer ineffective behaviors than Teams 2 and 3. Specifically, a total of 99 effective behaviors were reported for Team 1, whereas only 70 and 60 effective behaviors were reported for Teams 2 and 3, respectively. In contrast, Team 1 exhibited only nine ineffective behaviors as compared to 35 and 16 for Teams 2 and 3, respectively. Averaging over sessions, it is possible to determine from Table 3 that Team 1 emmitted an average of only 2.25 ineffective behaviors per session, whereas Teams 2 and 3 averaged 8.5 ineffective behaviors per session.

TABLE 3

Frequencies of Reports of Critical Team Behaviors for Three Teams

Behavioral Dimension	Team	Effective Behaviors (E) Session* 1P	2A	2P	3A	3P	4A	4P	Ineffective Behaviors (I) Session* 1P	2A	2P	3A	3P	4A	4P	Total (E/I)
Team Spirit	1	4	-	7	-	5	-	6	0	-	0	-	0	-	0	22/0
	2	7	7	5	6	-	-	-	1	2	1	0	-	-	-	25/4
	3	7	-	8	-	-	-	-	0	-	0	-	-	-	-	15/0
Coordination	1	8	-	7	-	6	-	6	1	-	0	-	0	-	0	27/1
	2	2	4	3	1	-	-	-	2	2	0	3	-	-	-	10/7
	3	9	-	4	-	-	-	-	2	-	1	-	-	-	-	13/3
Cooperation	1	2	-	5	-	4	-	4	0	-	1	-	1	-	0	15/2
	2	3	1	5	5	-	-	-	2	1	0	1	-	-	-	14/4
	3	6	-	8	-	-	-	-	4	-	1	-	-	-	-	14/5
Communication	1	4	-	4	-	4	-	4	3	-	1	-	0	-	0	16/4
	2	2	0	1	0	-	-	-	3	2	1	2	-	-	-	3/8
	3	5	-	2	-	-	-	-	3	-	4	-	-	-	-	7/7
Giving Suggestions	1	2	-	0	-	2	-	1	0	-	1	-	0	-	1	5/2
	2	2	2	3	3	-	-	-	1	2	1	1	-	-	-	10/5
	3	8	-	2	-	-	-	-	1	-	0	-	-	-	-	10/1
Adaptability	1	1	-	3	-	2	-	3	0	-	0	-	0	-	0	9/0
	2	4	1	1	0	-	-	-	1	2	2	1	-	-	-	6/6
	3	0	-	1	-	-	-	-	0	-	0	-	-	-	-	1/0
Accepting Suggestions	1	2	-	0	-	2	-	1	0	-	0	-	0	-	0	5/0
	2	1	0	1	0	-	-	-	0	1	0	0	-	-	-	2/1
	3	0	-	0	-	-	-	-	0	-	0	-	-	-	-	0/0
Totals	1	23	-	26	-	25	-	25	4	-	3	-	1	-	1	99/9
	2	21	15	19	15	-	-	-	10	12	5	8	-	-	-	70/35
	3	35	-	25	-	-	-	-	10	-	6	-	-	-	-	60/16
TOTAL		79	15	70	15	25	-	25	24	12	14	8	1	-	1	229/60

* 1P= Day 1 P.M. 2A= Day 2 A.M. 2P= Day 2 P.M. 3A= Day 3 A.M. 3P= Day 3 P.M. 4A= Day 4 A.M. 4P= Day 4 P.M. No data were collected in the sessions where the dash (-) occurs.

Viewed somewhat differently, these data indicate that a total of 92% (99 of 108) of the behaviors reported for Team 1 were effective behaviors, while only 8% of their reports involved ineffective behaviors. On the other hand, only 66% (70 of 105) of the critical behaviors for Team 2 were reported to be effective, whereas 33% were reported as ineffective behaviors. Similarly, 79% (60 of 76) of the critical behaviors for Team 3 were effective and 21% were ineffective. Thus, it appears that the better team emitted relatively more effective and relatively fewer ineffective behaviors. Furthermore, it appears that the behavioral dimensions of Coordination, Communication, and Adaptability show the greatest differential between effective and ineffective behaviors for the more effective and less effective teams.

One of the clearest differences between teams is noted in the data related to the role of the instructor. The frequencies of instructor involvement in the ctitical team behaviors are given in Table 4 for each dimension and each team. These data show that the instructor was much more actively involved as a participant in Teams 2 and 3 than in Team 1. This trend is most obvious in the dimension of Team Spirit where there was no instructor involvement for Team 1, but an average of nearly six instructor-initiated interventions per session for Teams 2 and 3. Overall, there was an average of over seven instructor-initiated interventions and nearly nine other instructor involvements per session for Teams 2 and 3, but only about one such involvement per session for Team 1. These high levels of instructor involvement appear to have been necessary because the members of the less effective teams failed to assume responsibility for maintaining team member interest and enthusiasm, and for cooperative efforts that are necessary to improve the efficiency of teams.

Interviews with the instructors revealed that they viewed enthusiasm and the "right" attitude as "the most important difference between good and poor teams." The right attitude encompassed an interest in training, a desire to learn, and a desire to do well. One instructor observed that "if a team has a good attitude, it will usually become a good team". Apparently, strong leaders failed to emerge in Teams 2 and 3 and the instructor felt a greater need to encourage team spirit, cooperation, etc. in those teams in order to provide a model of effective leadership. Not enough is known to define instructor actions that might help or inhibit the development of leaders and efficiency in these teams. However, whatever the result of this interplay between the instructor and the team, it is clear that the instructor plays a different role in the better and the poorer teams, and that his judgment and the nature of his intervention is crucial to the development of a team. This highlights the importance of the current efforts to provide ways

to assist the instructor with decisions concerning the kind of instructions/feedback which should be provided to a given team and when.

The Development of Team Member Roles

Several trends were noted in the development of the role of team leaders, individual team members, and instructors within the teams. The development of these roles was evidenced by the type and number of behaviors in which each member was regularly involved. That is, these observations are based on a detailed examination of the specific responses that were summed to provide the frequencies reported in Table 4. These data indicated that only Team 1 experienced the emergence of a clear team leader (i.e., the CIC Supervisor). The data for Team 1 also suggest that team members assumed specific roles within that team. For example, the RT-talker and RT-recorder were rarely involved in critical behaviors. On the other hand, the Nav-Plotter, Target-Plotter, and AGLO were consistently involved in critical behaviors on several dimensions (although their involvement was less than that of the CIC Supervisor).

The GLO occupied a unique role in Team 1. He was involved in effective behaviors on only two dimensions. Of particular interest was his role involving the Effective Acceptance of Suggestions or Criticism. Several times on Day 1 the GLO positively reinforced other team members who offered comments aimed at improving the team's performance. For example, he thanked the CIC Supervisor for correcting him when he made an error. The GLO appeared to establish a positive working environment on Day 1 and to maintain that environment throughout training. The positive relationships established by the GLO could have enabled the effective team roles to evolve and the team leader to emerge as discussed above. In contrast to Team 1, roles in the teams that performed less effectively (Teams 2 and 3) were not clearly developed. The GLO in Team 3 began to emerge as a leader on the second day of training (as evidenced by an increase in the number of effective behaviors on the dimension of Coordination). However, he continued to repeat ineffective behaviors relating to the order of communications, and the addition of needless comments to prescribed commands. Thus, he did not appear to exhibit the level of competency displayed by the GLO in Team 1.

TABLE 4

Frequency of Instructor Involvement in Critical Team Behaviors

Behavioral Dimension	Team	Instructor Initiated (E) Session* 1P	2A	2P	3A	3P	4A	4P	Instructor Involved (I) Session* 1P	2A	2P	3A	3P	4A	4P	Total (E/I)
Team Spirit	1	0	-	0	-	0	-	0	0	-	0	-	0	-	0	0/0
	2	6	6	4	6	-	-	-	6	6	4	6	-	-	-	22/22
	3	4	-	5	-	-	-	-	4	-	6	-	-	-		9/10
Coordination	1	0	-	0	-	0	-	0	0	-	1	-	0	-	0	0/1
	2	0	0	0	0	-	-	-	0	0	0	0	-	-	-	0/0
	3	1	-	0	-	-	-	-	1	-	0	-	-	-	-	1/1
Cooperation	1	0	-	0	-	0	-	0	0	-	0	-	0	-	0	0/0
	2	2	0	2	1	-	-	-	2	0	3	2	-	-	-	5/7
	3	1	-	3	-	-	-	-	1	-	3	-	-	-	-	4/4
Communication	1	0	-	0	-	0	-	0	0	-	4	-	0	-	0	0/4
	2	0	0	0	0	-	-	-	0	0	1	0	-	-	-	0/1
	3	0	-	0	-	-	-	-	0	-	0	-	-	-	-	0/0
Giving Suggestions	1	0	-	0	-	0	-	0	0	-	0	-	0	-	1	0/1
	2	0	0	0	0	-	-	-	0	0	1	0	-	-	-	0/1
	3	0	-	0	-	-	-	-	1	-	0	-	-	-	-	0/1
Adaptability	1	0	-	0	-	0	-	0	0	-	0	-	0	-	1	0/1
	2	1	1	0	0	-	-	-	2	1	1	0	-	-	-	2/4
	3	0	-	0	-	-	-	-	0	-	1	-	-	-	-	0/1
Accepting Suggestions	1	0	-	0	-	0	-	0	2	-	0	-	0	-	0	0/2
	2	0	0	0	0	-	-	-	1	0	0	0	-	-	-	0/1
	3	0	-	0	-	-	-	-	0	-	0	-	-	-	-	0/0
Totals	1	0	-	0	-	0	-	0	2	-	5	-	0	-	2	0/9
	2	9	7	6	7	-	-	-	11	7	10	8	-	-	-	29/36
	3	6	-	8	-	-	-	-	7	-	10	-	-	-	-	14/17
TOTAL		15	7	14	7	0	-	0	20	7	25	8	0	-	2	43/72

* 1P= Day 1 P.M. 2A= Day 2 A.M. 2P= Day 2 P.M. 3A= Day 3 A.M. 3P= Day 3 P.M. 4A= Day 4 A.M. 4P= Day 4 P.M. No data were collected in sessions where the dash (-) occurs.

Of the GLOs, the least effective was the one for Team 2. This individual consistently communicated information out of order and often added unnecessary comments to the prescribed commands. Although he was involved in the majority of effective behaviors on the Cooperation dimension, he usually was the recipient of assistance. To the extent that he initiated behaviors on this dimension, it was to ask for assistance. During the afternoon of the second day, the CIC Supervisor passed written notes to the GLO concerning his performance. According to the instructor, this action was extreme, and typically born of frustration. However, it clearly illustrates the lack of development exhibited by this team for which no clear leader and no clear team-member roles were developed.

Sensitivity of Dimensions

As discussed above, several dimensions of team behaviors (e.g., Team Spirit, Coordination, Cooperation, and Adaptibility) were particularly sensitive to the differences between the good and poorer teams. In addition, the dimensions of Effective Communication, Ineffective Cooperation, and Effective Acceptance of Suggestions or Criticism appear to reflect differences in the patterns of team development. Other dimensions also indicate some similarity in the patterns of development for all teams. These commonalities included increased incidents of Cooperation, as training progressed, and reduced numbers of incidents of Ineffective Coordination. Also, throughout training all teams displayed a relatively large number of behaviors related to Effective Team Spirit and Morale (see Table 3), although the level of involvement of the instructor varied considerably across teams. Consistent with these findings was the fact that many more effective than ineffective behaviors were reported by instructors for all three teams.

Summary

In summary, data examined in this study support the following conclusions:

* The good team displayed proportionately more effective behaviors and fewer ineffective behaviors than the poorer teams.

* The good team displayed a wider range of critical behaviors, and the leader of this team emmitted the same effective behaviors in all training sessions. In contrast, the less effective teams displayed much less variety in critical behaviors, and their leaders displayed fewer behaviors consistently across the training sessions.

* In the good team, a clear leader emerged and team members took on clearly defined roles. In contrast, no leader and no clear team roles developed in the less effective teams.

* The instructor played a much more active role in the training of less effective teams.

* There were some similarities in the development of teams over training. These similarities were shown in increases or decreases in the incidences of Cooperation, Ineffective Coordination, an Effective Team Spirit and Morale as training progressed.

There are promising indications here of the validity of the TEAM model (as illustrated in Figure 6). The critical team behaviors data provide evidence of a high level of instructor involvement in the basic mission and pre-midterm phases, but not in later phases. Additionally for the effective team, the emergence of a team leader is demonstrated during the pre-midterm phase. Furthermore, the effective team demonstrated an improvement in communications that began during the initial phase of training. The ineffective teams did not show such a trend, and this can be considered to be a necessary team skill that was not properly trained in those teams. This suggests something of the potential benefits that might be gained from specific instruction on the generic team skills of cooperation and communication.

TRAINEE QUESTIONNAIRE

The 21-item Trainee Questionnaire, with response categories of "Strongly Agree" (A), "Agree" (a), "Not Sure" (?), "Disagree" (d), and "Strongly Disagree" (D), was administered to the individual team members twice a day when possible (after each morning and afternoon session). Items were scored from the responses on a 5-point scale with "1" indicating strong agreement with statements reflecting negative perceptions of the team, "3" corresponding to the neutral or "not sure" attitude about an item, and "5" indicating strong agreement with items reflecting positive perceptions of the team. The obtained scores were averaged across items and across team members to provide overall session means and standard deviations (SD) of members' perceptions of team performance. These statistics are provided in Table 5 for each team and session for which data were collected.

TABLE 5

Average Responses to the Trainee Questionnaire for Each Team and Session

		DAY							
		1	2		3		4		5
		PM	AM	PM	AM	PM	AM	PM	AM
Team 1	Mean	3.07	3.21	3.28	3.72	3.77	3.86	3.86	3.92
	SD	.47	.45	.30	.27	.20	.24	.24	.22
Team 2	Mean	-	3.27	3.20	3.09	3.31	-	-	-
	SD	-	.43	.45	.46	.37	-	-	-
Team 3	Mean	2.98	3.05	2.25	3.10	-	-	-	-
	SD	.42	.50	.68	.44	-	-	-	-
Team 4	Mean	2.91	-	2.63	2.77	2.77	2.95	-	2.99
	SD	.53	-	.44	.20	.20	.27	-	.44

Team 1 is the only team for which a complete set of data was obtained (this team completed training at noon on Day 5). The instructors' evaluation of this team as "good" is reflected in the relatively high questionnaire scores for Team 1, which showed a definite trend toward more positive perceptions (higher scores) as training progressed. Team 1 also demonstrates a trend toward decreased variability in members' scores with a small but steady decline in the standard deviations across sessions. Although this team began training with a fairly high opinion of its capabilities as a unit, team members apparently became even more aware of this as training progressed. The decreasing response variability for this team suggests that as teams evolve into a cohesive unit, team members become more homogeneous in their perceptions of the team. In addition, as the team works together the members see themselves as becoming more unified, with performance improving over time. This information is comparable to data from the Critical Team Behaviors Form, which indicate that team-member interactions (communication, coordination, etc.) were also good for Team 1.

The data in Table 5 also reflect changes for teams that had difficulty during training. For example, the instructor verbally indicated that Team 3 had major difficulties in performing during the Pre-midterm Phase (Day 2, PM). The Trainee Questionnaire data reflect this in terms of a comparatively marked decrease in the average rating (less positive) and an increase in the standard deviation for that session. Although data are not available for Team 3 during the last four sessions, the midterm ratings (Day 3, AM) indicate that the perceptions of this team returned to previous levels. This is consistent with the instructor's anecdotal comment that they "...got it sort of together at the midterm." The fact that the initial ratings for Team 3 were very close to those for all of the teams, demonstrates a widely held belief of the instructors, that nearly all teams, good or bad, come to training with the attitude that they are not going to have any problems performing during training. Apparently, after performing the initial tasks, they begin to change their perceptions to accomodate to the reality of the situation. Team 3 may have realized that it was not quite as good as it had thought while Team 1 members became even more convinced of their ability to perform well.

Team 4, which performed nearly as well as Team 1, presents a slightly different picture. First, Team 4 indicated overall lower scores on the Trainee Questionnaire than any other team. Second, Team 4 demonstrates initially higher scores followed by a dip which then increases gradually to the same level as on Day 1; a pattern similar to that of the two poor teams. Finally, Team 4 demonstrated a trend towards decreased variability in responses as positive performance perceptions decreased and increased variability in responses as positive perceptions increased (the opposite of the pattern exhibited by the three other teams). Based on the data obtained from the Trainee Questionnaire and performance scores from the midterm and final, it is possible to generate a hypothesis regarding these differences. Team 4 was comprised of several relatively inexperienced personnel, who according to the instructor, did not believe they had the necessary individual skills to perform the task. When their performance exceeded their expectations, the belief was that the instructors were being "nice." Therefore, they still believed that the team collectively was performing poorly. Unfortunately there are no data from the Critical Behaviors Forms for this team. Therefore, it is not possible to empirically support this hypothesis. However, it does illustrate the need for multiple data sources, in that the team members apparently are not always the best judges of how they are performing.

Table 6 explores the previous point in terms of the scores obtained for the questionnaire items that comprise the Team Cooperation dimension. These data indicate that Team 1 experienced a clear increase in perceptions regarding the

cooperativeness of team members, and that there was no variance in these ratings toward the end of training. Across the other teams, in general, there was a decrease in the Pre-midterm (Day 2, PM) scores and a steady increase until the end of training. These data are interpreted as support for the notion advanced by Gersick (1985) that there is a transition point where the team re-evaluates its performance in light of training goals.

TABLE 6

Average Cooperation Scores from the Trainee Questionnaire for Each Team and Session

		DAY							
		1	2		3		4		5
		PM	AM	PM	AM	PM	AM	PM	AM
Team 1	Mean	3.04	3.10	3.30	3.82	3.87	3.97	3.97	4.00
	SD	.54	.32	.25	.11	.09	.06	.06	0
Team 2	Mean	-	3.43	3.32	3.06	3.46	-	-	-
	SD	-	.17	.11	.36	.13	-	-	-
Team 3	Mean	2.98	3.25	2.38	3.23	-	-	-	-
	SD	.34	.19	.49	.28	-	-	-	-
Team 4	Mean	3.18	-	2.38	2.83	2.80	2.90	-	3.08
	SD	.23	-	.64	.21	.07	.26	-	.21

As a whole, data from the Trainee Questionnaire suggest a definite pattern of team performance perceptions as training progresses. This pattern is illustrated by scores which decreased during the Pre-midterm Phase (less efficient) and then increased (more efficient) steadily to the Final Phase. Because the data for all of the questionnaire dimensions tended to follow this same pattern, correlations probably exist among dimensions.

Summary

These results suggest:

* Team members entering training often do not have a realistic expectation of their individual performance skills (they think they are better than they are).

* Just prior to the Midterm Phase, the teams have a difficult time (e.g., performing more poorly than expected, having leadership problems, experiencing difficulties with the training environment).

* Individual trainees frequently do not have an accurate picture of the team's performance ability.

This suggests that training efforts designed to enhance the generic team skills (communication, coordination, etc.) should be focused on pre-midterm training. Efforts designed to enhance operational skills should be done early in training. If this suggestion is supported by future data collection efforts, training interventions will be proposed to focus on correcting these problems at the most appropriate time.

DISCUSSION OF FINDINGS AND IMPLICATIONS

This research program was prompted by a gap in scientific understanding concerning how teams learn to work together, develop skills and behaviors that facilitate teamwork, and enhance their performance as a team. This gap translates into several salient questions: How do the behaviors and interactions among team members change over time? What are the crucial elements and patterns of team evolution and maturation? What makes a team's performance more than the aggregate of its individual technical skills? How can the pertinent variables be identified and measured?

During the first year of a long term research program, questions such as these were translated into four major objectives. Thus, the principle outcomes that were sought from this effort may be summarized as follows:

(1) To review research in the theoretical and applied areas of team processes, performance and training;

(2) To construct a stage model to provide the framework for longitudinal evaluations of team performance;

(3) To develop a system for measuring team processes and performance during training; and

(4) To recommend further team-training research, evaluation, and operational innovations and initiatives.

The overview of the current research will be organized under headings that address these objectives. Where the findings warrant, implications will be explored for subsequent research concerning the implemention of changes in equipment design, operational procedures, and training.

REVIEW OF RESEARCH

This research began with an extended review of the previous team training/performance literatures. The review has been updated continuously, and freely supplemented by consultations with experts in the field. Information obtained from these sources has reinforced the impression that there is a dearth of longitudinal studies that focus on the psycho-social processes involved in team performance. Similarly, few studies were found that incorporate these "team skills" into the design and evaluation of team training. Most research has focused on the acquisition of technical-individual skills. Many previous

studies employed atheoretical research designs to address more or less adventitiously available targets. A substantial portion of such work is found in the technical reports of research conducted under military auspices. However, much was learned from these reports and conversations with their authors and sponsors, especially about the problems that must be dealt with in obtaining data from operational units and training installations in the field.

The search for applicable theoretical concepts included a survey of the literature on group psychology by authors in social, organizational, and clinical psychology. The benefits of this exposure are reflected in the model presented earlier in this report, most notably in the contributions derived from Tuckman (1965) and Gersick (1985).

MODEL BUILDING

The practical value of constructing a theoretical model as a framework for programmatic research was amply illustrated by this research. The complexity of the operations which were studied and the scant longitudinal field research on team evolution and maturation, could have produced pressures to move simultaneously in several directions, and to exceed the boundaries of available time, resources, and present knowledge. However, efforts were made to focus activities so as to articulate a reasonably consistent, goal-orientated rationale that would impose discipline upon the project's thinking, planning, and prioritization. Building upon the theoretical foundations of others, a developmental framework was developed to represent the requirements of operational training systems (Figure 4). The procedures developed and the data collected within this framework have built confidence in the meaningfulness of this rationale and in the ability to translate it into valuable recommendations for the enhancement of team training.

PROTOTYPE MEASUREMENT

Plans for the data collection in this research were keyed to the need to observe and assess behavior, not just appraise performance outcomes. The limits of what could be observed and recorded by the available observers soon became obvious. Experimentation with the use of video recording also revealed distinct limitations. The time, space, materials, people, and cost required to obtain satisfactory transcriptions was prohibitive for routine data collection purposes. Nonetheless, videotaping should be explored as a way to meet other objectives. For example, video recordings of several teams could provide "live" examples for training at the school and aboard ship,

especially in the interval between the school training and the live firing qualifications run, and for teams who fail to complete the NGFS course. Later phases of this research program will consider further the potential utility of videotape technology for NGFS as well as other training programs.

SUMMARY OF FINDINGS

As presented earlier, the data reported here tend to support the following general conclusions concerning teams observed during training:

* It is possible to observe team behavior changing over time using the newly developed methodologies.

* It is possible to discriminate effective from ineffective teams using the TEAM methodologies.

* Instructors function as an important team member, particularly in poorer teams, and their behaviors change as training progresses.

* At least in good teams, training results in the sequential development of critical team behaviors.

* Team members become more similar in their perceptions of team behavior as training progresses.

* Good teams tend to exhibit a relatively higher number of effective behaviors and a relatively lower number of ineffective behaviors than poorer teams.

* The TEAM methodologies seem to measure processes that are important to the development of effective team behaviors.

From a practical standpoint, instructors and trainees provide the best information concerning "what goes on" while they are working together. This was certainly true for the Critical Team Behaviors Form, which produced the kind of information required by the TEAM model for future applications to training. Instructors indicated that the derived interpretations of the team behaviors "makes sense" and can be useful to them. In most cases, this belief is strong enough to justify the extra work that the required data collection schedule imposes on them. Revisions in the instructions, content, and format of the instrument and changes in administrative procedures to increase interaction between instructors and researchers, should further facilitate its use.

Furthermore, the interpretations that have been made here are in agreement with past research and other sources of information (e.g., observations of ongoing training and other archival data at NGFS). The measures obtained from the Critical Team Behaviors Form and the Trainee Questionnaire appear to reflect real changes in team performance. The frequencies of effective and ineffective behaviors obtained from the Critical Team Behaviors Form provide meaningful comparisons of ships, sessions, and dimensions of behavior. The Trainee Questionnaire reflects the perceptions of behaviors and performances that are of greatest importance for successful teams--or at least for the Naval Gunfire Support teams.

The next phase of this research will test the generality of the data and interpretations reported here. Current interpretations can apply only to Naval Gunfire Support training. However, the experience with these measurement approaches suggests that there should be no great obstacle in using them in other types of training and operations.

FUTURE DIRECTIONS

The next stage of this work will begin by refining the current measures. Reliability will be tested through more extensive data collection at the Naval Gunfire Support School. Once the methodology has been refined and proven reliable at this site, generalizability will be tested through application of the model and methods to other types of teams. Preliminary recommendations for team training interventions will then be drafted. These interventions may be aimed at any aspect of the training, such as the task, the simulation, the team, or the instruction, with an emphasis on the measurement of performance.

The next step will be to apply the new technologies and determine their relative efficacy for team training. This will be accomplished by incorporating the validated concepts, measures, and procedures into existing training programs using an experimental design that will allow determination of intervention effectiveness. This effort will include:

* formatting the TEAM protocol to selected team training program designs;
* producing the instruments, manuals, and documentation necessary for using the methodology to guide team development during training; and
* field-testing the materials with end-point users.

The objective is to demonstrate these new tools can be integral parts of established training systems design. Research will involve experimentally testing training regimens with and without new TEAM approaches. The emphasis will be on producing consumer/trainer-oriented materials which can be easily administered and interpreted during training. The materials will be evaluated using simulation-based trainers, and will be refined in accordance with trainer performance, reactions, and suggestions. The ultimate goal of this operation is to adapt and develop team-process measurement for convenient use by the personnel actually doing the team training in the field. Consideration will be given to ease of use, time and effort needed for measurement, technologies available for collecting information, interpretability and utility of data, and expertise of users.

At the end of this task, a training design program/TEAM measurement system which can be implemented in the field will be put into effect. The approach will demonstrate the utility of TEAM methods and concepts in training (e.g., faster and more effective team skill acquisition; less interpersonal friction and greater cohesion). The system must be designed to assist instructors' diagnoses of process-related behaviors, their recognition of process-outcome linkages, and their correction of behavior patterns when deficiencies are found. For example, if a team adapts poorly to changing task demands, and if this process is important to performance at the team's particular stage of development, the system must train this particular skill.

For example, the Instructor's Diagnostic Aid for Feedback in Training (IDAFT, Andrews & Uliano, 1985)--designed to help the instructor identify critical team behaviors, diagnose applicable instructional strategies, and offer feedback prescriptions to correct problems within the team--might be modified to include the variables and solutions identified by the TEAM research. IDAFT could be particularly valuable as an aid to instruction in less formalized shipboard or embedded training situations. It would also help to standardize team training across instructors. Other potential interventions include methods for integrating new members into an established team, for facilitating the early development of team leaders, and for speeding the development of effective communication patterns among team members.

TECHNICAL SOLUTIONS

Recent team training designs are showing signs of improvement. R&D and operational programs are placing greater emphasis on team behaviors and processes. Such programs can be found at United Airlines, the Nuclear Regulatory Commission, Seville Training Systems, the Naval Personnel research and

Development Center, and in the two earlier mentioned operational team trainers under development at the Naval Training Systems Center and the current effort.

These training programs also incorporate instructional aids and procedures (e.g., automated alerts, performance measurement, etc.) to help guide instruction toward team training elements. Finally, system designers are beginning to use systematic, ISD-like approaches to develop instruction that is based on behavior-oriented team training objectives. Table 7 lists the major system elements through which program designers are shaping these new technological trends. These new approaches should greatly improve team training in the future.

PAYOFFS

As a near-term payoff, the current research can help to substantially reduce the failure rate of trainees at NGFS. Approximately 400 (of 2,000 total) trainees fail to graduate from the NGFS program each year. Since these failures are primarily attributed to failures in generic team skills such as communication and coordination (personal communication, Grafton, April 1986), TEAM technologies should be useful in reducing the failure rate and in producing graduates who perform more effectively in the Fleet. Ongoing efforts to apply information from this project to team trainers acquired by the Naval Training Systems Center should also improve instruction in those systems and help justify their costs. Finally, it is hoped that the current R&D will stimulate interest and increased efforts on team training issues so that anticipated benefits can multiply.

Over a longer term, R&D such as reported here should reduce training costs and system development time by 50% or more. Savings of this magnitude have been achieved for individual skills training, in large part, by designing to meet training (rather than simulation) requirements (e.g., Caro, Corley, Spears, & Blaiwes, 1984). Similar approaches should produce comparable savings for team training.

TABLE 7

Elements of Team Training Design

Training Objectives (generic and specific)
Performance Measures
Data Collection Techniques
Data Processing Techniques
Data Display Techniques
Trainee Briefings
Performance Demonstrations
Exercise Development
Exercise Selection
Instructor Alerts
Exercise Control
Performance Cueing and Coaching
Diagnostic Feedback
Remedial Instruction
Operational Readiness/Qualification
Instructor/Operator Training
Instructor/Operator/Trainee Guides
Instructor Workload
User Acceptance
Training Effectiveness Evaluation

In addition, enhanced team training should reduce the loss of personnel. For example, the Naval Safety Center reports in their Spring, 1985 Bulletin an average of one mishap per month for Navy aircraft in 1985. These accidents translated into five deaths and a loss of $50 million in aircraft for each month of 1985. These losses could be reduced by improving team training technologies. The ultimate goal of this and future TEAM research will be to provide the technologies that will contribute to enhanced team training, improved team performances, reduced training costs, and decreased losses due to accidents.

References

Alluisi, E.A., "Lessons From a Study of Defense Training Technology," Educational Technology Systems, Vol. 5, No. 1, pp. 57-76, 1977.

Andrews, D.H., and Uliano, K.C., "An Instructor's Diagnostic Aid for Feedback in Training," Journal of Industrial Teacher Education, 1985.

Bales, R.F., and Strodtbeck, F.L., "Phases in Group Problem Solving," Journal of Abnormal and Social Psychology, Vol. 46, pp. 485-495, 1951.

Ball, F.M., "Application of Instructional System Development Techniques to Team Training," Proceedings of the 4th Interservice/Industry Training Equipment Conference, Analysis and Technology Inc., Groton, CT., pp. 16-18, 1982.

Bass, B., "Individual Capability, Team Performance, and Team Productivity," In E.A. Fleishman & M.D. Dunnette (Eds.), Human Performance and Capability: Human Capability Assessment, Earlbuam, Hillsdale, NJ., 1982.

Baum, D., Modrick, J., and Hollingsworth, S., The Status of Air Force Team Training for Command and Control Systems, Report No. 81SRC14, Honeywell Systems and Research Center, Minneapolis, MN., 1981.

Bell, M.A., "Phases in Group Problem-Solving," Small Group Behavior, Vol. 13, No. 4, pp. 475-495, 1982.

Bennis, W.G., and Shepard, H.A., "A Theory of Group Development," Human Relations, Vol. 9, No. 4, pp. 415-437, 1956.

Bennis, W.G., and Shepard, H.A., "A Theory of Group Development," In G.S. Gibbard et al. (Eds.), Analysis of Groups, Jossey Bass Publishers, San Francisco, CA., 1974.

Binning, J.F., & Lord, R.G., "Boundary Conditions for Performance Cue Effects on Group Process Ratings: Familiarity Verses Type of Feedback," Organizational Behavior and Human Performance, Vol. 26, pp. 115-130, 1980.

Boguslaw, R., & Porter, E.H., "Team Functions and Training," In R.M. Gagne (Ed.), Psychological Principles on System Development, Holt, Rinehart and Winston, New York, 1962.

Bowen, D.D., and Siegel, J.P., "Process and Performance: A Longitudinal Study of the Reactions of Small Task Groups to Periodic Performance Feedback," Human Relations, Vol. 26, No. 4, pp. 433-448, 1973.

Briggs, G.E., and Johnston, W.A., Team Training: Final Report, February 1966-February 1977, Report No. 1327-4, United States Naval Training Device Center, Orlando, FL., 1967.

Briggs, G.E., and Naylor, J.C., "Team Versus Individual Training, Training Task Fidelity and Task Organization Effects of Transfer Performance by Three-Man Teams," Journal of Applied Psychology, Vol. 49, pp. 387-392, 1965.

Caple, R.B., "The Sequential Stages of Group Development," Small-Group Behavior, Vol. 9, No. 4, pp. 470-477, 1978.

Caro, P.W., Corley, W.E., Spears, W.D., and Blaiwes, A.S., Training Effectiveness Evaluation and Utilization Demonstration of a Low Cost Cockpit Procedures Trainer. NAVTRAEQUIPCEN 78-C-0113-3, 1984.

Cherns, A.B., "Principles of Socio-Technical Design," Human Relations, Vol. 29, pp. 783-792, 1976.

Cissna, K.N., "Phases in Group Development: The Negative Evidence," Small Group Behavior, Vol. 15, No. 1, pp. 3-32, 1984.

Collins, J.J. A Study of Potential Contributions of Small Group Behavior Research to Team Training Technology, Contract No. N0014-76-C-1076, Essex Corporation, Alexandria, VA., 1977.

Crowe, W., Hicklin, M., Kelly, M., Obermayer, R., and Satzer, W., Team Training Through Communcations Control Final Report, Report No. NAVTRAEQUIPCEN 80-C-0095-1, Vreuls Research Corporation, Thousand Oaks, CA., 1982.

Cummings, T.G., "Socio-Technical System: An Intervention Strategy," In W. Burke (Ed.), Current Issues and Strategies in Organizational Development, Human Science Press, New York, 1976.

Davis, L.E., "Evolving Alternative Organizational Designs: The Socio-Technical Bases," Human Relations, Vol. 30, pp. 261-273, 1977.

Davis, L.T., Gaddy, C.D., and Turney, J.R., An Approach to Team Skills Training of Nuclear Power Plant Control Room Crews, NUREG/CR-4258GP-R-123022, General Physics Corporation, Columbia, MD., 1985.

Denson, R.W., Team Training: Literature Review and Annotated Bibliography, AFHRL-TR-80-40, Wright Patterson Air Force Base, OH.: Logistics and Technical Training Division, Air Force Human Research Laboratory, 1981.

Dyer, J., State-of-the-Art Review on Team Training and Performance, Fort Benning, GA.: Army Research Institute Field Unit, 1984.

Emery, F.E., and Trist, E.L., "Analytical Model for Socio-Technical System," In W.A. Pasmore and J.J. Sherwood (Eds.), Socio-Technical System: A Sourcebook, University Associates, San Diego, CA., 1978.

Evans, N.S., and Jarvis, P.A., "Group Cohesion: A Review and Reevaluation," Small Group Behavior, Vol. 11, pp. 359-370, 1980.

Federman, P., and Siegel, A., Communications as a Measureable Index of Team Behavior, Naval Training Device Center, Orlando, FL., October, 1965.

Fisher, B.A., "Decision Emergence: Phases in Group Decision-Making," Speech Monographs, Vol. 37, No. 1, pp. 53-66, 1970.

Flanagan, J.C., "The Critical Incident Technique," Psychological Bulletin, Vol. 51, pp. 327-358, 1954.

Fleishman, E.A., and Hempel, W.E., Jr., "The Relation Between Abilities and Improvement With Practice in a Visual Discrimination Reaction Task," Journal of Experimental Psychology, Vol. 49, pp. 301-312, 1955.

Gersick, C.J.G., "Time and Transition in Work Teams: Towards a New Model of Group Development," Unpublished Manuscript, 1985.

Glickman, A.S., and Vallance, T.R., "Curriculum Assessment With Critical Incidents," Journal of Applied Psychology, Vol. 42, pp. 329-335, 1958.

Goldin, S.E., and Thorndyke, P.W. (Eds.), Improving Team Performance: Proceedings of the Rand Team Performance Workshop, R-2606-ONR, Rand Corporation, Santa Monica, CA., 1980.

Goldstein, I.L., Training In Organizations: Needs Assessment, Development, and Evaluation, 2nd edition, Brooks/Cole Publishing Co., Monerey, CA., 1986.

Goodstadt, B.E., Frey, R.L., and Glickman, A.S., Socialization Processes and the Adjustment of Military Personnel to Army Life, American Institutes for Research, Washington, DC., 1975.

Hackman, J.R., and Morris, C.G., "Group Tasks, Group Interaction Process, and Group Performance Effectiveness: A Review and Proposed Integration," In L. Berkowitz (Ed.), Advances in Experimental Social Psychology, Vol. 8, pp. 45-49, Academic Press, New York, 1975.

Hall, E.R., and Rizzo, W.A., An Assessment of U.S. Navy Tactical Training, TAEG Report No. 18, Training Analysis and Evaluation Group, 1975.

Horrocks, J., Heerman, E., and Krug, R.E., Team Training III: An Approach to Optimum Methods and Procedures, NAVTRADEVCEN 198-3, U.S. Naval Training Device Center, Port Washington, NY., 1961.

James, L.R., Gustafson, S.B., and Sells, S.B., Final Report: Development of Effective Leaders: The Need to Consider Situational Specificity Verses Cross-Situational Consistency, Contract No. NC0014-80-C-0315, Group Psychology Program: Office of Naval Research, Arlington, VA., 1985.

Johnston, W.A., "Transfer of Team Skills as a Function of Type of Training," Journal of Applied Psychology, Vol. 50, pp. 102-108, 1966.

Katz, D., and Kahn, R.L., The Social Psychology of Organizations, 2nd edition, John Wiley and Sons, New York, 1978.

Kell, C.L., and Corts, P.R., Fundamentals of Effective Group Communication, Pascmillin, New York, 1980.

Kennedy, J.L., "The System Approach: Organizational Development," Human Factors, Vol. 4, pp. 25-52, 1962.

Klaus, D.J., and Glaser, R., Increasing Team Proficiency Through Training: 8. Final Summary Report, AIR E 1-6/68FR, American Institutes for Research, 1968.

Knerr, C.M., Nadler, L., and Berger L., Toward a Naval Taxonomy, Contract No. N00014-80-C-0781, Litton Mellonics, Arlington, VA., 1980.

Kribs, D.H., Thurmond, P., and Mark, L., Computerized Collective Training for Teams, Report No. ARI-TR-&&-A4, Army Research Institute for the Behavioral and Social Sciences, Arlington, VA., 1977.

Lahey, G.G., and Slough, D.A., Relationship Between Communication Variables and Scores in Team Training Exercises, Report No. NPRDC-TR-82-25, Navy Personnel Research and Development Center, San Diego, CA., 1982.

Lavoie, D., and Culbert, S.A., "Stages of Organization and Development," Human Relations, Vol. 31, No. 5, pp. 417-438, 1978.

Lee, B.N., "Instructional System Development (ISD) - An Air Force Way of Life," In T.T. Liad and D.C. Miller (Eds.), Systems Approach to Instructional Design, Baywood Publishing Co. Inc., Farmingdale, New York, 1977.

Martinko, M.J., and Gardner, W.L., "Beyond Structured Observation: Methodological Issues and New Directions," Academy of Management Review, Vol. 10, No. 4, pp. 676-695, 1985.

McRae, A.V., Interaction Content and Team Effectiveness, Technical Report 66-10, Human Resources Research Office, Alexandria, VA., June, 1966.

Moreland, R.L., and Levine, J.M., "Socialization in Small Groups: Temporal Changes in Individual-Group Relations," Advances in Experimental Social Behavior, Vol. 15, pp. 137-192, 1982.

Morgan, B.B., Jr., Coates, G.D., Kirby, R.H., and Alluisi, E.A., "Individual and Group Performances as Functions of the Team Training Load," Human Factors, Vol. 26, pp. 127-142, 1984.

Nieva, V.F., Fleishman, E.A., and Rieck, A., Team Dimensions: Their Identity, Their Measurement and Their Relationships, Contract No. DAHC19-78-C-0001, Response Analysis Corporation, Washington, DC., 1978.

Pintrich, P.R., Cross, D.R., Kozma, R.B., and McKeachie, W.J., "Instructional Psychology," Annual Review of Psychology, Vol. 39, pp. 611-651, 1986.

Reigeluth, C.M., (Ed.), Instructional-Design Theories and Models: An Overview of Their Current Status, Erlbaum, Hilsdale, NJ., 1983.

Rynes, S.L., Heneman, H.G., and Schwab, D.P., "Individual Reactions To Organizational Recruiting: A Review," Personnel Psychology, Vol. 33, pp. 529-542, 1980.

Salas, E., Blaiwes, A.R., Reynolds, R.E., Glickman, A.S., and Morgan B.B., Jr., "Teamwork From Team Training: New Directions," Proceedings of the 7th Interservice/Industry Training Equipment Conference and Exhibition, American Defense Preparedness Association, Orlando, FL., 1985.

Shaw, M.E., Group Dynamics: The Psychology of Small Group Behavior, 2nd Edition, McGraw-Hill, New York, 1976.

Shifflett, S., Eisner, E.J., Price, S.J., and Schemmer, F.M., The Definition and Measurement of Team Functions, Technical Report ARRO-3068-FR-R81-4, Advanced Research Resources Organization, Alexandria, VA., 1982.

Slough, D.A., and Stern, H.W., Development of Antisubmarine Warfare Team Training Objectives, NPRDC Technical Note 81-18, Navy Personnel Research and Development Center, San Diego, CA., 1981.

Surface ASW Training System (Device 141412), Functional Description Contract No. N61339-80-D-0011, Naval Training Equipment Center, FL., 1982.

Terborg, J.R., Castore, C.H., and DeNinno, J.A., A Longitudinal Field Investigation of the Impact of Group Composition on Group Performance and Cohesion, Paper presented at the meeting of the Midwestern Psychological Association, Chicago, IL., May, 1975.

Thorndyke, P.W., and Weiner, M.G., Improving Training and Performance of Navy Teams: A Design for a Research Program, R-2607-ONR, Office of Naval Research, Washington, DC., 1980.

Thurmond, P. and Kribs, H.D., Computerized Collecive Training for Teams, Contract No. DANC19-76-C-0042 15-ARPA order-2887, US Army Research Institute for the Behavioral Social Sciences, Alexandria, VA., 1978.

Tuckman, B.W., "Developmental Sequence in Small Groups," Psychological Bulletin, Vol. 63, pp. 384-399, 1965.

Tuckman, B.W., and Jensen, M., "Stages of Small Group Development Revisited," Group and Organizational Studies, Vol. 2, pp. 419-427, 1977.

Tziner, A., "Differential Effects of Group Cohesiveness Types: A Clarifying Overview," Society for Personality Research, Vol. 10, No. 2, pp. 227-239, 1982.

Tziner, A., and Eden, D., "Effects of Crew Composition on Crew Performance: Does the Whole Equal the Sum of the Parts?," Journal of Applied Psychology, Vol. 70, pp. 85-93, 1985.

Wagner, H., Hibbits, N., Rosenblatt, R.D., and Schultz, R., Team Training and Evaluation Strategies: State-of-the-Art, Human Resources Research Organization, Alexandria, VA., 1977.

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APPENDIX A

Behaviors Associated with Stages of the TEAM Model

		Task-Oriented Activities	Group-Oriented Activities
	PRE-FORMING	* Development of assignments	* Investigation of group reputation
FIRST MEETING	FORMING	* Orientation to task + Evaluate task situation + Discover ground rules	* Testing and Dependence + Discover what behaviors are acceptable + Initial situational testing followed by leader dependence
PHASE I	STORMING	* Emotional response to task demand + Resistance to task demands on individual	* Intragroup conflict + Infighting + Expressions of individuality + Lack of unity
	NORMING	* Open exchange of relevant interpretations + Exchange interpretations + Act on information	* Development of group cohesion + Acceptance by members + Avoid conflicts + Negotiate roles
	PERFORMING I	* Emergence of solutions + Attempt to complete task	* Functional role relatedness + Problem solve + Adopt and play roles

APPENDIX A (Continued)

TRANSITION	REFORMING	* Framework adjustment + Environmental demands evaluated + Planning finalized + Refocus of effort	* Role adjustment + Pulling together + Activity directed towards deadlines + Agreement on goals
PHASE II	PERFORMING II	* Drive to completion + Skills become highly practiced/reach asymptote + Maintenance of skill level + Focus on completion + Focus on selected issues	* Fulfillment of roles + Work to maintain order + Maintenance of group structure/ functioning + Possible conflict
COMPLETION	CONFORMING	* Delivery of product + Work finalized + Prepared for delivery + Adjusted to fit context + No "new" work	* Adjustment to environmental demands + Self evolvement of team + Termination of relationships + Negative response to termination
	DEFORMING	* Withdrawal from task	* Exiting from group

APPENDIX B

Criteria for the Selection of a Data Collection Site

Primary Characteristics

Member Communication

* Extensive (verbal and nonverbal)
* Observable or trackable as much as possible for as many members as possible

Member Interaction

* Significant periods of performance time (more than 5 minutes)
* At least 2 members interacting at any one time throughout task

Member Interdependency

* As high as possible, with all working toward the same recognized goal
* Goal-oriented activities involving all or subsets of members
* Shared resources (information, KSAs)
* Sequenced or overlapping procedures

Situational Factors

* Stable, including training
* Newly formed teams
* Training is seen as necessary to job performance (high motivation)
* Initial skills training (prefer team training not individual skill training)
* Able to observe individual and team learning and improvement

Appendix B (Continued)

Performance Measures

- Formative as well as summative criteria available
- Quantitative measures available or can be developed.
- Able to track process and to identify intermediate outcomes
- Able to distinguish team from individual outcome and process measures

Secondary Characteristics

Data Collection Feasibility

- Team composition
- Fleet willingness to cooperate
- Task structure
- Geographical proximity

APPENDIX C

Team Training Sites Surveyed

COMMAND	TRAINER LOCATION	CONTACT
AIRBORNE EARLY WARNING SQUADRON 120 (VAW-120)	NAVAL AIR STATION NAVAL STATION NORFOLK	LCDR SMOLSKI DIR. OF TRAINING
NAVAL GUIDED MISSILES SCHOOL DETACHMENT (NAVGMSCOLDET)	DESTROYER AND SUBMARINE PIERS NAVAL STATION NORFOLK	CHIEF GRIFFEN INSTRUCTOR CHIEF TUDOR INSTRUCTOR
FLEET ASW TRAINING CENTER (FLEASWTRACEN)	DESTROYER AND SUBMARINE PIERS NAVAL STATION NORFOLK	CHIEF KILLIAN INSTRUCTOR
FLEET COMBAT TRAINING CENTER (FLECOMTRACEN)	FLEET COMBAT TRAINING CENTER DAM NECK	CDR BRIDGES DIR. OF TRAINING
COMBINED FIGHTER WING ONE (COMFITWING-1)	NAVAL AIR STATION OCEANA	ED PEEBLES INSTRUCTOR
NAVAL AMPHIBIOUS SCHOOL (NAMS)	NAVAL AMPHIBIOUS BASE LITTLE CREEK	LT GRAFTON DIR. OF TRAINING
FLEET TRAINING CENTER (FTC)	NAVAL STATION NORFOLK	CDR HOLK DIR. OF TRAINING

APPENDIX D

CIC Stations and Responsibilities in NGFS

* Gunnery Liaison Officer (GLO)

  (a) The GLO will be thoroughly familiar with the duties of the R/T Talker, NAV Plotter, Assistant Plotter.
  (b) He will always ensure that the target is plotted correctly.
  (c) He will be thoroughly familiar with the duties of the GLO as prescribed in NWIP22-2 and Supplement to NWIP 22-2.
  (d) He is in charge of the GFS team in CIC and is responsible to the Evaluator.

* Assistant GLO

  (a) Operates the grip spot converter to convert spots from observer target line (OTL) to gun target line (GTL) or line of fire (LOF) for illumination rounds in indirect fire.
  (b) Compares the converted spots with the GLO before dissemination to plot.

* CIC Supervisor

  (a) Supervises the operation of CIC, all equipment in CIC, and the personnel directly concerned with the mission of CIC.
  (b) Keeps the Evaluator and GLO informed of all combat info.

* R/T Talker

  (a) Must have thorough knowledge of R/T procedures and NGF terminology.
  (b) Talks directly with spotter and works in close harmony with GLO.
  (c) Displays fire mission data on status board.
  (d) Reads back data to spotter.
  (e) Reports GTL and time of flight when ready to fire.

* Navigation (Fix) Log Recorder

  (a) Conducts time check with the bridge.
  (b) Keeps latest navigational information posted for the plotter's use.
  (c) Maintains communications with visual bearing takers, surface search or fire control radar operators.

Appendix D (Continued)

* R/T Recorder

  (a) Monitors Spotter net.
  (b) Keeps fire mission data for permanent record.
  (c) Good position for breaking in a new R/T Talker.

* Navigation Plotter.

  (a) Establish and maintain continuous navigational track, including a six (6) minute DR, to facilitate opening fire.
  (b) Compute set and drift and check frequently.
  (c) Determine target's course and speed.
  (d) Assist the GLO in obtaining computer checks (every 15 seconds) until plot set is received.

* Target Plotter

  (a) Locate and plot no fire lines.
  (b) Plot any known enemy positions.
  (c) Plot and indicate targets received on fire missions.
  (d) Check height of target and terrain clearance.
  (e) Assist the GLO and DRT plotter with computer checks.
  (f) The plotter's right hand man, assist in every way possible.

Appendix E

Critical Team Behaviors

Date:_____ Ship:_____

Session: (circle One) Day of Training: (Circle One)

Morning Afternoon 1 2 3 4 5

Significant Incidents

Date: _____ Ship: _____

Session: (Circle one)

Morning Afternoon

Day of Training: (Circle one)

1 2 3 4 5

Effectively Giving Suggestions or Criticism

During the last set of exercises that you observed, did you see any of these things happen that significantly affected work outcomes? (1) X the positions of the team members who were involved; (2) Circle the (X) of the individual(s) who did what you marked. (INS = Instructor; EXT = External)

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT
1. Raised question about incorrect procedure used by a senior member of the team.									
2. Called attention to a mistake made by another member without being negative.									
3. Asked if the procedure or information was correct when he wasn't sure.									
4. Suggested to another member that he recheck his work so that he could find his own mistake									
5. Member silently pointed to a mistake made by another member rather than announcing the mistake.									

If the incident took place more than once, write the number of the incident on the back of the page and fill in the boxes the same way.

Can you give a description of another significant incident involving giving suggestions or criticism that was particularly effective? (Describe on the other side)

Describe what happened.

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT

Ineffective Cooperation

During the last set of exercises that you observed, did you see any of these things happen that significantly affected work outcomes? (1) X the positions of the team members who were involved; (2) Circle the (X) of the individual(s) who did what you marked. (INS = Instructor; EXT = External)

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT
1. Indicated that he knows his job and shouldn't have to worry about someone else's job.									
2. Failed to assist another member who was having difficulty and let him fail.									
3. Member became overloaded and failed to ask for assistance.									
4. Tried to push another member out of the way and do his job for him.									
5. Was uncertain what to do next and failed to ask for help.									

If the incident took place more than once, write the number of the incident on the back of the page and fill in the boxes the same way.

Can you give a description of another significant incident involving cooperation that was particularly ineffective? (Describe on the other side)

Describe what happened.

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT

Effective Acceptance of Suggestions or Criticism

During the last set of exercises that you observed, did you see any of these things happen that significantly affected work outcomes? (1) X the positions of the team members who were involved; (2) Circle the X of the individual(s) who d d what you marked. (INS = Instructor; EXT = External)

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT
1. Asked what he had done wrong when told that he had made a mistake.									
2. Asked other team members to tell him if he made an error.									
3. Thanked another member for catching his mistake.									

If the incident took place more than once, write the number of the incident on the back of the page and fill in the boxes the same way.

Can you give a description of another significant incident involving acceptance of suggestions or criticism that was particularly effective? (Describe on the other side)

Describe what happened.	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT

Effective Communication

During the last set of exercises that you observed, did you see any of these things happen that significantly affected work outcomes? (1) X the positions of the team members who were involved; (2) Circle the (1) of the individual(s) who did what you marked. (INS = Instructor; EXT = External)

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT
1. Communicated information to another member in the proper order.									
2. Used the proper terminology when communicating information.									
3. Spoke loudly and distinctly when communicating information.									
4. Asked for specific clarification on a communication that was unclear.									

If the incident took place more than once, write the number of the incident on the back of the page and fill in the boxes the same way.

Can you give a description of another significant incident involving communication that was particularly effective? (Describe on the other side)

Describe what happened.

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT

Ineffectively Giving Suggestions or Criticism

During the last set of exercises that you observed, did you see any of these things happen that significantly affected work outcomes? (1) X the positions of the team members who were involved; (2) Circle the (X) of the individual(s) who did what you marked. (INS = Instructor; EXT = External)

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT
1. Ridiculed another member who had made a mistake.									
2. Raised his voice when correcting another member.									
3. Noticed a mistake and did not mention it.									

If the incident took place more than once, write the number of the incident on the back of the page and fill in the boxes the same way.

Can you give a description of another significant incident involving giving suggestions or criticism that was particularly ineffective? (Describe on the other side)

Describe what happened.	GLC	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT

Ineffective Communication

During the last set of exercises that you observed, did you see any of these things happen that significantly affected work outcomes? (1) X the positions of the team members who were involved; (2) Circle the (X) of the individual(s) who did what you marked. (INS = Instructor; EXT = External)

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT
1. Lowered his voice and mumbled when communicating information to other team members.									
2. Communicated information out of order.									
3. Added his own comments to the prescribed commands, thereby wasting time.									
4. Ignored information from another member who had previously made errors.									
5. Gave a different interpretation to information provided by another member because of errors previously made by that member.									
6. Failed to ask for clarification on a communication that was unclear.									
7. Members were talking among themselves and missed a communication.									

If the incident took place more than once, write the number of the incident on the back of the page and fill in the boxes the same way.

Can you give a description of another significant incident involving communication that was particulary ineffective? (Describe on the other side)

Describe what happened.

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT

Effective Team Spirit and Morale

During the last set of exercises that you observed, did you see any of these things happen that significantly affected work outcomes? (1) X the positions of the team members who were involved; (2) Circle the (X) of the individual(s) who did what you marked. (INS = Instructor; EXt = External)

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT
1. Made comments like, "We're going to get it right this time."									
2. Patted another member on the back.									
3. Stood next to another member when the latter had a difficult task to perform.									
4. Discussed ways of improving team performance.									
5. Made positive comments about the team.									
6. Praised another member for doing well on a task.									
7. Consoled another member who had made a mistake.									
8. Made a joke to lighten the tension.									
9. Made positive statements about the training.									

If the incident took place more than once, write the number of the incident on the back of the page and fill in the boxes the same way.

Can you give a description of another signficant incident involving team spirit and morale that was particularly effective? (Describe on the other side)

Describe what happened.	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT

Ineffective Adaptability

During the last set of exercises that you observed, did you see any of these things happen that significantly affected work outcomes? (1) X the positions of the team members who were involved; (2) Circle the Ⓧ of the individual(s) who did what you marked. (INS = Instructor; EXT = External)

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT
1. Member was unable to adapt to information provided out of order and missed necessary information.									
2. Tried to get out of doing a task that was not part of his job.									
3. Refused to change the way he did a task even though he was doing it wrong.									

Did you notice anything else done by team members involving adaptability that was particularly ineffective? (Describe on the other side)

Describe what happened.	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT

Effective Cooperation

During the last set of exercises that you observed, did you see any of these things happen that significantly affected work outcomes? (1) X the positions of the team members who were involved; (2) Circle the (Y) of the individual(s) who did what you marked. (INS = Instructor; EXT = External)

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLU	R/T TAL	R/T REC	INS	EXT
1. Checked with other team members when uncertain about what to do next.									
2. Helped another member who was having difficulty with a task.									
3. Prompted another member on what he had to do next.									
4. Gave suggestions on how to do a task.									
5. Member who needed assistance asked for help.									
6. To help another member, performed a task that was not part of his job.									
7. Wrote down notes for another team member on the performance of the latter's job.									

If the incident took place more than once, write the number of the incident on the back of the page and fill in the boxes the same way.

Can you give a description of another significant incident involving cooperation that was particularly effective? (Describe on the other side)

Describe what happened.

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT

Ineffective Team Spirit and Morale

During the last set of exercises that you observed, did you see any of these things happen that significantly affected work outcomes? (1) X the positions of the team members who were involved; (2) Circle the Ⓧ of the individual(s) who did what you marked. (INS = Instructor; EXT = External)

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT
1. Ignored a member who is not liked.									
2. Formed subgroups or cliques.									
3. Said something like, "This team isn't worth anything" or "This team isn't going to make it."									
4. Argued among themselves.									
5. Blamed each other for the failure of the team on an exercise.									
6. While waiting for information from another member, began to harass the other member.									
7. Made negative comments about another member's performance.									
8. Made negative comments about the value of the training.									

If the incident took place more than once, write the number of the incident on the back of the page and fill in the boxes the same way.

Can you give a description of another incident involving team spirit and morale that was particularly ineffective? (Describe on the other side)

Describe what happened.

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT

Ineffective Acceptance of Suggestions of Criticism

During the last set of exercises that you observed, did you see any of these things happen that significantly affected work outcomes? (1) X the positions of the team members who were involved; (2) Circle the (2) of the individual(s) who did what you marked. (INS = Instructor; EXT = External)

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT
1. Told other members to worry about their own jobs and let him alone.									
2. Argued with another member who said he had made an mistake.									

If the incident took place more than once, write the number of the incident on the back of the page and fill in the boxes the same way.

Can you give a description of another significant incident involving acceptance of suggestions or criticism that was particularly ineffective? (Describe on the other side)

Describe what happened.

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT

Ineffective Coordination

During the last set of exercises that you observed, did you see any of these things happen that significantly affected work outcomes? (1) X the positions of the team members who were involve; (2) Circle the (X) of the individual(s) who did what you marked. (INS = Instructor; EXT = External)

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT
1. Was not ready with information when another member needed it.									
2. Indicated that he was finished with a task before he really was so that he could beat the clock.									
3. When serving as a backup for another member, confirmed information without checking it.									
4. Failed to provide information unless asked.									

If the incident took place more than once, write the number of the incident on the back of the page and fill in the boxes the same way.

Can you give a description of another significant incident involving coordination that was particularly ineffective? (Describe on the other side)

Describe what happened.

	GLO	A GLO	C&C SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT

Effective Adaptability

During the last set of exercises that you observed, did you see any of these things happen that significantly affected work outcomes? (1) X the positions of the team members who were involved; (2) Circle the (X) of the individual(s) who did what you marked. (IMS = Instructor; EXT = External)

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT
1. Member was able to adapt to information provided in the wrong order and made sure that he had all of the necessary information.									
2. Performed a task outside of his job because the team needed to have the work done.									
3. Provided suggestions on the best way to locate an error.									
4. Changed the way he performed a task when asked to do so.									

If the incident took place more than once, write the number of the incident on the back of the page and fill in the boxes the same way.

Can you give us a description of another incident involving adaptability that was particularly effective? (Describe on the other side)

Describe what happened.	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT

Effective Coordination

During the last set of exercises that you observed, did you see any of these things happen that significantly affected work outcomes? (1) X the positions of the team members who were involved; (2) Circle the (X) of the individual(s) who did what you marked (INS = Instructor; EXT = External)

	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT
1. When he finished one task, began working on another task.									
2. Required information from more than one person Obtained information from those who were ready while others finished their tasks.									
3. Provided information that was needed before being asked for it.									
4. Was ready with information when other members needed it.									
5. Provided direction on what the members had to do next.									
6. Attempted to determine the cause of discrepant information before going on.									
7. When not busy with his job, watched what the other members of the team were doing.									

If the incident took place more than once, write the number of the incident on the back of the page and fill in the boxes the same way.

Can you give a description of another significant incident involving coordination that was particularly effective? (Describe on the other side)

Describe what happened.	GLO	A GLO	CIC SUP	NAV PLO	TAR PLO	R/T TAL	R/T REC	INS	EXT

NTSC TR-86-014
Appendix F
Trainee Questionnaire

TEAM	AGLO	Nav Plot	R/T Talker
BILLET	CIC SUP	NAV Recorder	Target Plot
(Circle One)	GLO	R/T Recorder	Other_____

Set of Exercises Just Completed (circle one)
Morning Afternoon

Day of Training: (Circle one)
1 2 3 4 5

Think about the exercises in the last training session in which you took part. Circle the letter that shows how much you agree or disagree with each statement. If you are "not sure", circle the question mark (?). The "team" means you and the other CIC personnel from your ship.

The only people who are going to see your answers are the ODU researchers.

	Strongly Agree	Agree	Not Sure	Dis-agree	Strongly Disagree
1. Members of my team knew how to perform their required duties in this set of exercises.	A	a	?	d	D
2. Members of my team exchanged ideas about how to proceed in this set of exercises.	A	a	?	d	D
3. Members of my team cooperated with each other during the exercises.	A	a	?	d	D
4. Members of my team gave their best effort in this set of exercises.	A	a	?	d	D
5. Members of my team kept me informed about the things I needed to know to do my job.	A	a	?	d	D
6. When members of my team had questions, we could turn to others for help.	A	a	?	d	D
7. Members of my team had confidence in the accuracy of the information we got from the spotter, bridge, and plot.	A	a	?	d	D
8. Communications were always clear among members of my team.	A	a	?	d	D
9. The activities of my team were well organized.	A	a	?	d	D
10. I knew exactly what I as supposed to do during the exercises.	A	a	?	d	D
11. The final outcomes of this set of exercises were mostly the result of what our team members did; not what other people did.	A	a	?	d	D

	Strongly Agree	Agree	Not Sure	Dis-agree	Strongly Disagree
. My team sent accurate information to the spotter, bridge, and plot at the appropriate times.	A	a	?	d	D
. My team felt that our success as a group was more important than the success of any individual member.	A	a	?	d	D
. Success in my job depended heavily on the actions of other team members.	A	a	?	d	D
. It took too long to coordinate information in my team.	A	a	?	d	D
. I completely understood how my position fits in with the work of other members of the team.	A	a	?	d	D
. In this set of exercises, the leader of my team showed that he is concerned about the welfare of the team members.	A	a	?	d	D
3. I was satisfied with my team's performance on these exercises.	A	a	?	d	D
9. This set of training exercises has improved the performance of our team.	A	a	?	d	D

). Which individual was the "most valuable player" on the team during this set of exercises? (Check one)

___AGLO ___Instructor ___R/T Talker

___CIC SUP ___Nav Plot ___Target Plot

___GLO ___Nav Recorder ___None of the above

___R/T Recorder

1. Which individual was the "least valuable player" on the team during this set of exercises? (Check one)

___AGLO ___Instructor ___R/T Talker

___CIC SUP ___Nav Plot ___Target Plot

___GLO ___Nav Recorder ___None of the above

___R/T Recorder

Appendix G
Team Demographics

Instructions: The following information will remain confidential and is for research only. Each team member should fill in all questions carefully and completely.

INDIVIDUAL INFORMATION

WHAT IS YOUR CURRENT RANK _____ RATE _____

WHAT IS YOUR BILLET ON THE NAVAL GUNFIRE SUPPORT TEAM? _____

GLO _____	NAV PLOTTER _____	R/T TALKER _____
AGLO _____	TARGET PLOTTER _____	R/T RECORDER _____
CIC SUPERVISOR _____	NAV RECORDER _____	OTHER _____

HOW LONG HAVE YOU BEEN IN THE NAVY? (CIRCLE YEARS AND MONTHS)
YEARS <1 1 2 3 4 5 6 7 8 9 10 11-15 >15 MONTHS <1 1 2 3 4 5 6 7 8 9 10 11

HOW LONG HAVE YOU HELD YOUR CURRENT RANK OR RATE? (CIRCLE YEARS AND MONTHS)
YEARS <1 1 2 3 4 5 >5 MONTHS <1 1 2 3 4 5 6 7 8 9 10 11

HOW LONG HAVE YOU BEEN IN YOUR CURRENT COMMAND? (CIRCLE YEARS AND MONTHS)
YEARS <1 1 2 3 4 5 >5 MONTHS <1 1 2 3 4 5 6 7 8 9 10 11

HOW LONG HAVE YOU BEEN ASSIGNED TO THE NGFS TEAM AT YOUR CURRENT COMMAND? (CIRCLE YEARS AND MONTHS)
YEARS <1 1 2 3 4 5 >5 MONTHS <1 1 2 3 4 5 6 7 8 9 10 11

HOW LONG HAVE YOU HELD YOUR CURRENT BILLET ON THE NGFS TEAM AT YOUR CURRENT COMMAND? (CIRCLE YEARS AND MONTHS)
YEARS <1 1 2 3 4 5 >5 MONTHS <1 1 2 3 4 5 6 7 8 9 10 11

CHECK ANY OTHER OF THE FOLLOWING BILLETS THAT YOU HAVE HELD ON THIS TEAM.

GLO _____	NAV PLOTTER _____	R/T TALKER _____
AGLO _____	TARGET PLOTTER _____	
CIC SUPERVISOR _____	NAV RECORDER _____	R/T RECORDER _____

WHICH OF THE FOLLOWING SCHOOLS HAVE YOU ATTENDED IN THE LAST 3 YEARS?

A SCHOOL _____	LMET _____
C SCHOOL _____	RADAR NAV _____

IF YOU HAVE PREVIOUSLY COMPLETED THIS TRAINING WITH YOUR CURRENT COMMAND, INDICATE WHEN AND THE BILLET HELD. YOU MAY CHECK MORE THAN ONE.

	BILLET
IN THE LAST 6 MONTHS _____	_____
BETWEEN 12 & 6 MONTHS AGO_____	_____
BETWEEN 1 & 2 YEARS AGO _____	_____
BETWEEN 2 & 3 YEARS AGO _____	_____
OVER 3 YEARS AGO _____	_____

WHILE YOU HAVE BEEN IN YOUR CURRENT BILLET ON THIS TEAM HOW OFTEN HAVE YOU TRAINED WITH THIS TEAM? (CHECK)

MORE THAN TWICE A WEEK _____	1 TO 2 TIMES A QUARTER
1 TO 2 TIMES A WEEK _____	NEVER _____
1 TO 2 TIMES A MONTH _____	OTHER _____

Appendix G

Team Demographics

TEAM FORM C

TEAM CODE NUMBER _____

INDIVIDUAL INFORMATION

WHAT IS YOUR CURRENT RANK OR RATE? _____

WHAT IS YOUR BILLET ON THE NAVAL GUNFIRE SUPPORT TEAM?

GLO ____	NAV PLOTTER ____	R/T TALKER ____
AGLO ____	TARGET PLOTTER ____	
CIC SUPERVISOR ____	NAV RECORDER ____	R/T RECORDER ____

HOW LONG HAVE YOU BEEN IN THE NAVY? (CIRCLE YEARS AND MONTHS)
YEARS 1 2 3 4 5 6 7 8 9 10 11-15 15 MONTHS 1 2 3 4 5 6 7 8 9 10 11

HOW LONG HAVE YOU HELD YOUR CURRENT RANK OR RATE? (CIRCLE YEARS AND MONTHS)
YEARS 1 2 3 4 5 5 MONTHS 1 2 3 4 5 6 7 8 9 10 11

HOW LONG HAVE YOU BEEN IN YOUR CURRENT COMMAND? (CIRCLE YEARS AND MONTHS)
YEARS 1 2 3 4 5 5 MONTHS 1 2 3 4 5 6 7 8 9 10 11

HOW LONG HAVE YOU BEEN ASSIGNED TO THE NGFS TEAM AT YOUR CURRENT COMMAND? (CIRCLE YEARS AND MONTHS)
YEARS 1 2 3 4 5 5 MONTHS 1 2 3 4 5 6 7 8 9 10 11

HOW LONG HAVE YOU HELD YOUR CURRENT BILLET ON THE NGFS TEAM AT YOUR CURRENT COMMAND? (CIRCLE YEARS AND MONTHS)
YEARS 1 2 3 4 5 5 MONTHS 1 2 3 4 5 6 7 8 9 10 11

CHECK ANY OTHER OF THE FOLLOWING BILLETS THAT YOU HAVE HELD ON THIS TEAM.

GLO ____	NAV PLOTTER ____	R/T TALKER ____
AGLO ____	TARGET PLOTTER ____	
CIC SUPERVISOR ____	NAV RECORDER ____	R/T RECORDER ____

WHICH OF THE FOLLOWING SCHOOLS HAVE YOU ATTENDED IN THE LAST 3 YEARS?

A SCHOOL _____	LMET _____
C SCHOOL _____	RADAR NAV _____

IF YOU HAVE PREVIOUSLY COMPLETED THIS TRAINING WITH YOUR CURRENT COMMAND, INDICATE WHEN AND THE BILLET HELD. YOU MAY CHECK MORE THAN ONE.

	BILLET
IN THE LAST 6 MONTHS ____	_____
BETWEEN 12 & 6 MONTHS AGO ____	_____
BETWEEN 1 & 2 YEARS AGO ____	_____
BETWEEN 2 & 3 YEARS AGO ____	_____
OVER 3 YEARS AGO ____	_____

WHILE YOU HAVE BEEN IN YOUR CURRENT BILLET ON THIS TEAM HOW OFTEN HAVE YOU TRAINED WITH THIS TEAM? (CHECK)

MORE THAN TWICE A WEEK ____	1 TO 2 TIMES A QUARTER
1 TO 2 TIMES A WEEK ____	NEVER ____
1 TO 2 TIMES A MONTH ____	OTHER ____

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